

Space for recovery after stroke: Exploring the role of
the physical environment in inpatient rehabilitation
facilities

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Abstract

The aim of this thesis was to explore the role of the physical environment of inpatient rehabilitation facilities in stroke recovery. The purpose of rehabilitation is to help stroke survivors to re-learn skills and abilities lost as a result of stroke, or to learn new skills to adapt to their changed condition. Research in other healthcare environments suggests that hospital design can impact patient outcomes, but there is little evidence specific to rehabilitation. This thesis embraces the complexity of rehabilitation environments and explores the physical environment as an essential and integrated component of this complex system.

This exploration began with a scoping survey to identify and describe all inpatient rehabilitation facilities in Victoria, Australia. This survey revealed 64 facilities, most of which had not been purpose-built for rehabilitation. Rehabilitation facility design appears to be influenced by evidence from acute medical settings and current design trends, rather than reflecting the unique purpose of rehabilitation.

A series of expert elicitation workshops were then conducted to define – for the first time – what is important in the physical environment of inpatient stroke rehabilitation facilities. Thirty experts participated, including policy makers, researchers and designers in learning and healthcare environments, clinical staff, and patients. A Value-Focused Thinking methodology was used to facilitate the workshops. The experts defined 16 criteria thought to be fundamentally important (including efficiency, patient practice, activity and rest, emotional well-being, and safety), and 14 criteria that could be a means to achieving these fundamentally important things. Together, these criteria comprise a framework which can be used to guide research and design in this complex area.

This framework informed a multiple-case study in two stroke inpatient rehabilitation facilities. Convergent mixed-methods were used to produce a rich and thorough exploration of the cases. Twenty inpatients from Case 1 participated, and 16 from Case 2. The physical environment was described using field notes, photographs, floor plans, and checklists. Walk-through semi-structured interviews were used to explore patients' experience of the physical environment. Systematic observation (behavioural mapping) and questionnaires were used to investigate patients' behaviour and emotional well-being in the environment, and a retrospective audit of patient falls was conducted to investigate patient safety.

Four interrelated themes described the patient experience: 1) entrapment and escape; 2) power, dependency, and identity in an institutional environment; 3) the rehabilitation facility is a shared space; and 4) the environment should be legible and patient-centred. Quantitative data revealed that patients spent over 75% of their time in their bedrooms. Comparison between cases suggested that the physical environment played a role in patients' behaviour, emotional well-being, and safety. Qualitative and quantitative findings were then merged using joint display tables and narrative integration. This robust analytic process produced a new conceptual model of the role of the physical environment in stroke patients' behaviour, emotional well-being, and safety in rehabilitation, emphasising the importance of variety and interest in the environment, privacy without isolation, and patient-centred design. The findings from this study provide meaningful direction for rethinking rehabilitation facilities and guiding real-world health design practice.

Declaration

I, Ruby Lipson-Smith, declare that:

- i. this thesis comprises only my original work towards the degree of Doctor of Philosophy except where indicated in the preface;
- ii. due acknowledgement has been made in the text to all other material used;
and
- iii. this thesis is fewer than the maximum word limit in length, exclusive of tables, references, and appendices.

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Date: 15 May 2020

Preface

All the work in this thesis is original. None of the work in this thesis was carried out prior to enrolment in this degree, and none of it has been submitted for other qualifications. No third party has provided editorial services.

This is a thesis with publication. As first author I have contributed more than half of the work towards the included publications, including the design of the studies, collecting, analysing and interpreting the data, writing, and revising the manuscripts. All authors have signed the co-author authorisation forms for these publications (see Appendix 1). Two publications have been included in this thesis:

1. Lipson-Smith, R., Zeeman, H., & Bernhardt, J. (2020) What's in a building?: A descriptive survey of adult inpatient physical rehabilitation facility buildings in Victoria, Australia. *Archives of Rehabilitation Research and Clinical Translation*.
2. Lipson-Smith, R., Churilov, L., Newton, C., Zeeman, H., & Bernhardt, J. (2019) A Framework for Designing Inpatient Stroke Rehabilitation Facilities: A New Approach Using Interdisciplinary Value-Focused Thinking. *Health Environments Research and Design*.

All of the research in this thesis was conducted under the supervision of my PhD supervisors, Prof Julie Bernhardt and Prof Heidi Zeeman. Two of the studies in this thesis involved collaboration with others, in addition to my supervisors. I was responsible for the conceptualisation, design, data collection, analysis, and dissemination of all of the research in this thesis, but I would like to acknowledge the contribution and assistance of the following people:

Chapter 3 – Interdisciplinary expert elicitation workshops

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Publications and presentations

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“[A person] is never encountered independent of the situation through which [that person] acts, nor is the environment ever encountered independent of the encountering individual. It is meaningless to speak of either as existing apart from the situation in which it is encountered” (Ittelson, 1973, p. 18).

1 Introduction

1.1 Thesis rationale

1.1.1 *Evidence-based healthcare design can improve outcomes*

We enter hospital buildings at our most vulnerable, and trust that these spaces will help us to heal. Governments and communities invest vast financial resources to build and maintain these essential, high-stakes buildings and there is understandable expectation that they should perform optimally. In recent decades, researchers have demonstrated the impact of the hospital physical environment on clinical outcomes (Devlin & Arneill, 2003; Marberry, 2006; Ulrich et al., 2008). Architects, designers, and healthcare planners have used this evidence to inform the design of new hospital buildings. These evidence-informed buildings have led to measurable improvements in clinical and economic performance (Joseph & Hamilton, 2008; Sadler et al., 2011; Sadler, DuBose, & Zimring, 2008).

Most healthcare design research has focused on the requirements of acute patient populations, where clinical priorities include diagnosis, acute management, and infection control (Hamilton, 2013; Stiller, Salm, Bischoff, & Gastmeier, 2016). There has also been targeted research in specific patient groups, including mental health (Connellan et al., 2013; Papoulias, Csipke, Rose, McKellar, & Wykes, 2014), maternity (Foureur, Leap, Davis, Forbes, & Homer, 2011; Setola et al., 2019), and dementia care (Chaudhury, Cooke, Cowie, & Razaghi, 2017; Marquardt, Bueter, & Motzek, 2014). The success of the evidence-based healthcare environment design in other patient populations indicates that the physical environment is an important factor to consider in inpatient stroke rehabilitation.

1.1.2 ***Stroke rehabilitation patients have unique needs and clinical priorities***

Stroke can impact any aspect of a person's physical or cognitive functioning and it is a leading cause of death and disability worldwide (World Health Organization, 2019). After receiving acute care, stroke patients are often transferred to a sub-acute inpatient rehabilitation facility to receive personalised rehabilitation therapy. In Australia, stroke patients spend an average of 5.5 weeks in inpatient rehabilitation (Australasian Rehabilitation Outcomes Centre (AROC), 2019), which is longer than most acute inpatient stays post-stroke. The number of Australians who require stroke rehabilitation is set to increase in the coming decades as stroke incidence escalates, acute treatments improve and more people survive a stroke (Stroke Foundation, 2017).

The term 'rehabilitation' refers to the process of care, as opposed to the outcome (Bernhardt et al., 2017). The aim of the stroke rehabilitation process is to maximise patients' participation in and quality of life by: 1) helping patients to re-learn the skills or abilities that they lost as a result of their stroke, such as walking, arm-use, speaking, or understanding speech, and/or 2) helping patients to learn new skills to adapt to their changed condition, such as how to use a walking frame. Whether re-learning old skills or learning new skills, rehabilitation is a learning process where the (desired) outcome is recovery of skills, abilities, and activities.

Clinical guidelines for stroke rehabilitation recommend that patients participate in targeted, goal-directed practice in and out of therapy, as well as engage in additional general physical and cognitive activity to promote their learning and recovery post-stroke (Stroke Foundation, 2019; Winstein et al., 2016). These recommendations are plainly in contrast to the acute clinical priorities that have

driven the evidence-based healthcare design of acute facilities. Stroke rehabilitation patients cannot be passive receivers of care; rather, they must be engaged and active participants. The unique needs and clinical priorities of stroke rehabilitation should be reflected in the physical environment of inpatient rehabilitation facilities in order to facilitate optimal patient engagement.

1.1.3 *There is limited evidence to inform the design of rehabilitation facilities*

Prior to commencing this thesis in 2016, there had been a handful of studies specific to the physical environment of inpatient rehabilitation spaces for stroke patients (Daemen, van Loenen, & Cuppen, 2014; Janssen et al., 2014b; Mackey, Ada, Heard, & Adams, 1996; McCunn & Gifford, 2013; Skubik-Peplaski, 2015; Turner, 2012), and some opinion pieces on the subject (Bernhardt & Cumming, 2013; Connell, 1997; Holmqvist & von Koch, 2001). A systematic literature review of research on stroke rehabilitation environments was therefore not of high scientific value for this thesis. The lack of research in the field is surprising given the vast amount of clinical stroke rehabilitation literature more broadly (Evidence Based Review of Stroke Rehabilitation (EBRSR), 2018). A recent systematic literature review on the topic of hospital room design for older people and people with neurological disorders revealed seven studies that included people with neurological disorders in their sample (Shannon et al., 2018). Only one of these studies had specified people with stroke as their population of interest (Daemen, Flinsenbergh, van Loenen, Cuppen, & Rajae-Joordens, 2014). Evidently, a gap exists in the healthcare design literature and there is limited evidence to inform inpatient stroke rehabilitation facility design.

The studies in the literature review by Shannon et al. were of variable methodological quality and used many different types of research designs (2018). The handful of stroke rehabilitation-specific studies listed in the paragraph above are similarly varied. Their research questions are drawn from clinical observations (Mackey et al., 1996; Turner, 2012), animal research (Janssen et al., 2014b), or other healthcare environments (McCunn & Gifford, 2013). They are missing a unified, underlying consideration of the role of the physical environment in stroke rehabilitation. What is the ultimate intent, or purpose of these spaces? There has been no systematic groundwork conducted to understand this. There is no clear understanding of which specific features in the physical environment are important for stroke rehabilitation, which aspects of the environment are worthy of further study, or which research methods should be used to investigate stroke rehabilitation environments. A collective understanding of the role of the physical environment in stroke rehabilitation is needed to inform and streamline research questions and methods. The intent of the research in this thesis was to address this knowledge gap.

1.2 Stroke rehabilitation is a learning and recovery process

The area of the brain damaged by a stroke cannot recover, but most stroke survivors experience functional improvements due to either adaptation or neuroplasticity in intact areas and networks of the brain (Bernhardt et al., 2017; Fridman et al., 2004; Murphy & Corbett, 2009). The learning process is defined in this thesis as the process by which human behaviour, abilities, skills, or knowledge change over time, where that change is not due to medication, trauma, disease, or aging (Mazur, 2013). The human brain continually reorganises to store new information, memories, abilities, and skills and to adapt to changing experiences and

environments. This reorganisation within the brain is called experience-dependent neuroplasticity, and can occur on a molecular, synaptic, or structural level (Draganski et al., 2004). Contemporary neuroscience suggests that all human learning, including learning after a stroke, is contingent on experience-dependent neuroplasticity (Kandel et al., 2013). As a patient's skills and abilities improve during stroke rehabilitation, their brain undergoes molecular, functional, and structural neuroplastic changes (Dimyan & Cohen, 2011; Johansson, 2011; Murphy & Corbett, 2009).

The impact of a stroke depends on many factors, including, but not limited to, the type, extent, and region of the stroke in the brain; the person's age and comorbidities; time to treatment; and type of acute treatment received. Every stroke patient's clinical profile is therefore unique when they enter rehabilitation. One person may be frail, cognitively incapacitated, and incapable of independent movement. Another may be young and otherwise healthy, but unable to use their arm or walk. And still another may be physically unaffected but cognitively impaired, e.g., unable to speak or understand speech. Clinical profile is not the only source of variability between stroke patients. Each patient is (obviously) a different person, who brings with them their own socioeconomic background, education, preferences, and personality. The unique clinical and personal profile of each patient means that every patient's learning and recovery process will be unique. In addition, a single patient's needs will vary over time as they recover from their stroke. As with all learning processes, the extent and nature of a patient's experience-dependent neuroplasticity, or learning after a stroke, is dependent on their experiences post-stroke (Kolb & Muhammad, 2014), and their experiences are a product of their engagement with their environment, their behaviour, and all the individual characteristics that makes every stroke patient unique (Carr & Shepherd, 2003, 2010).

1.2.1 ***Patients' behaviour is important***

The Australian stroke clinical guidelines for rehabilitation outline how best to facilitate the learning and recovery process after a stroke (Stroke Foundation, 2019). They address physical and cognitive rehabilitation, and provide evidence-based recommendations for the delivery, content, timing, and extent of therapy. The guidelines recommend that all patients participate in repetitive, targeted, and goal directed practice of the skills and abilities affected by their stroke in all domains of impairment. Generally, patients who do more practice experience better outcomes after stroke (Daly et al., 2019; English et al., 2016; Kwakkel et al., 2004), and repetitive, task-specific practice is widely accepted by health professionals and neuroscientists as beneficial to the experience-dependent neuroplasticity process (Arya, Pandian, Verma, & Garg, 2011; Dimyan & Cohen, 2011).

The guidelines also recommend that patients should be encouraged to be physically, cognitively, and socially active outside of their targeted therapy. Physical activity itself promotes neuroplasticity and learning (Mang, Snow, Wadden, Campbell, & Boyd, 2016; Ploughman, Austin, Glynn, & Corbett, 2015), and any incidental activity (physical, cognitive, or social) provides practice of tasks in different contexts, which may help patients to develop more transferable and generalisable skills.

In addition to practice and activity, stroke patients also need sleep and rest. Extreme fatigue is common after stroke, necessitating frequent periods of rest (Wu et al., 2015), and patients sometimes appreciate the quiet rest times between therapy sessions (Purcell, Scott, Gustafsson, & Molineux, 2019). Sleep quality post-stroke is also important. Sleep promotes neuroplasticity and is necessary for consolidating learning and memory (Krueger, Frank, Wisor, & Roy, 2016; Song & Cohen, 2014;

Yang et al., 2014). Good sleep promotes recovery after stroke, while disturbed sleep may negatively impact recovery (Duss et al., 2017; Gottlieb et al., 2019). Sleep and rest, like practice and activity, are important aspects of every patient's behaviour in the learning and recovery process after stroke. The physical environment must therefore aim to support activity, practice and rest after stroke.

1.2.2 ***Patients' emotional well-being is important***

The clinical and research communities have long recognised the deleterious impact of stress, depression, and low mood on stroke recovery (Sinyor et al., 1986). Chronic stress, such as that produced by stressful life events and sudden onset illnesses, is often intertwined with the incidence of depression. Both stress and depression may negatively impact neurogenesis and neuroplasticity (Pittenger & Duman, 2008), thereby impeding patients' neuroplasticity at the time they need it most and negatively impacting their recovery (Prajwal et al., 2020). In addition to the impacts of stress and depression, patients may feel that their practice and activity in rehabilitation is hampered by their boredom, lack of motivation, and perceived lack of autonomy (Luker, Lynch, Bernhardsson, Bennett, & Bernhardt, 2015). Patients need to be in a position that enables them to attend to clinical instruction and focus on their rehabilitation process. Clearly, a patient's internal state (i.e., their stress, mood, boredom, motivation, engagement, attention, and sense of autonomy) may impact their behaviour and therefore their re-learning and recovery post-stroke. In this thesis, the term 'emotional well-being' will be used to refer to this internal state. A patient with a beneficial emotional well-being would feel motivated, engaged, relaxed, and positive and may therefore participate in more practice, activity, and rest. A patient with a negative, or hindering emotional well-being would feel unmotivated,

disempowered, bored, stressed, and depressed and may therefore participate in less practice, activity, and rest.

Boredom has been associated with fatigue, depression, and apathy in patients with brain injury (Barbour & Mead, 2012; Goldberg & Danckert, 2013; Goldberg, Eastwood, LaGuardia, & Danckert, 2011). It is therefore critical to address boredom in stroke populations as it may negatively impact their motivation to participate in rehabilitation. The World Health Organisation defines motivation as the conscious or unconscious mental drive that produces the incentive to act (World Health Organization, 2001). Patients with low motivation for rehabilitation report having a less active role in their therapy than patients with high motivation (Maclean, Pound, Wolfe, & Rudd, 2000).

Motivation, engagement, and attention are described as related concepts in the rehabilitation literature. Patient engagement has been defined as the co-constructed connection between the patient and their therapy program “which enables the [patient] to become an active, committed and invested collaborator in healthcare” (Bright, Kayes, Worrall, & McPherson, 2015, p. 650). In order to be engaged, a patient must be motivated to attend and pay attention to the therapy program. Originally proposed by William James in 1890, attention is the process of selectively focusing on some aspect of our external environment or internal train of thought. Attention is crucial for any learning process, and can be negatively affected by neurological changes following stroke (Olgiati, Russell, Soto, & Malhotra, 2016). Patient motivation, engagement, and attention are clearly important for learning and for patients’ ability to take on an active role in the rehabilitation process.

Related to this are the concepts of patient autonomy and empowerment, that is, their right and ability to make their own decisions and act as they wish, which is

arguably the ultimate goal of rehabilitation (Cardol, Jong, & Ward, 2002). The clinical guidelines recommend that patients in rehabilitation set their own goals for recovery, and that the goals should be well-defined, challenging, and meaningful to the patient (Stroke Foundation, 2019). Self-directed goal-setting improves patients' engagement in rehabilitation (Sugavanam, Mead, Bulley, Donaghy, & Van Wijck, 2013). Although people tend to learn faster through supervised learning, self-directed learning appears to lead to better retention and generalisability of skills, possibly because there is more variability during practice (Hasson, Manczurowsky, & Yen, 2015; Lee, White, & Carnahan, 1990; Winstein, Pohl, & Lewthwaite, 1994).

1.2.3 *Learning after stroke can be difficult*

The process of learning after a stroke is akin to any learning process, but the nature of stroke can make this process extremely difficult for patients. Stroke survivors may have compromised learning abilities for at least six months following stroke (Lam et al., 2016). Difficulty learning is a predictor of recovery after brain injury (Uprichard, Kupshik, Pine, & Fletcher, 2009), and many stroke survivors experience changes that affect their ability to learn, including fatigue (Wu et al., 2015), depression (Kouwenhoven, Kirkevold, Engedal, & Kim, 2011), and/or generalised cognitive impairments (Cumming, Marshall, & Lazar, 2013; Liu & Lou, 2018).

Depending on the country and the study, stroke patients reportedly receive between 22 and 90 minutes of therapy per day while in inpatient rehabilitation (West & Bernhardt, 2012). In most countries, with the exception of the USA, therapy duration is not mandated, but instead is driven by local resources, systems, and norms. The amount of time that patients spend in therapy or practicing the required tasks is likely to be less than what is expected or recommended (Ada, Mackey, Heard, &

Adams, 1999), and less than what is required to produce the necessary neuroplastic change (Lang et al., 2009).

Since patients are only engaged in structured therapy for a short time each day, skills practice must continue outside of therapy sessions. Unfortunately, despite the stroke rehabilitation guidelines, stroke patients are largely inactive and alone outside of their scheduled therapy time (King, McCluskey, & Schurr, 2011; Mackey et al., 1996; Sjöholm et al., 2014; West & Bernhardt, 2012). In addition, sleep disorders are common after stroke (Duss et al., 2017; Gottlieb et al., 2019), which suggests that patients may not get the necessary effective rest.

Patients' emotional well-being post-stroke is often not optimal for learning. Post-stroke depression and anxiety are common (Burton et al., 2013; Hackett, Yapa, Parag, & Anderson, 2005). Many stroke patients report feeling bored while they are in hospital (Kenah et al., 2017). Stroke survivors often (at least temporarily) lose many of the naturally rewarding things in their lives, which may make it harder to feel motivated (Robertson, 2013). Patients do not always feel empowered, and they report difficulty setting their own goals in the months following stroke; some may feel hampered by their limited health literacy, and poor understanding of stroke recovery and goal setting terminology (Laver, Halbert, Stewart, & Crotty, 2010; Luker et al., 2015). Evidently, stroke patients need to be supported and encouraged to have optimal emotional well-being and to participate in the behaviours that are most beneficial post-stroke, namely practice, activity, and rest. The physical environment is one means of supporting these optimal internal states and behaviours.

1.3 Defining the physical environment

This thesis positions healthcare design research within the field of People-Environment studies. Researchers in People-Environment studies, or Environmental Psychology, explore relationships between people and their environment (Bechtel & Churchman, 2003). Depending on the research question, ‘the environment’ may refer to a social environment, physical environment, geopolitical environment, global or local environment, to name a few. The environment in this sense is a broad concept, akin to ‘context’ or ‘setting’, which acknowledges the complexity of the systems in which humans operate (Wapner & Demick, 2003). A person’s inpatient rehabilitation after stroke typically involves interactions between that person (the patient), the social environment (including clinical and care processes), and the physical environment (see Figure 1.1).

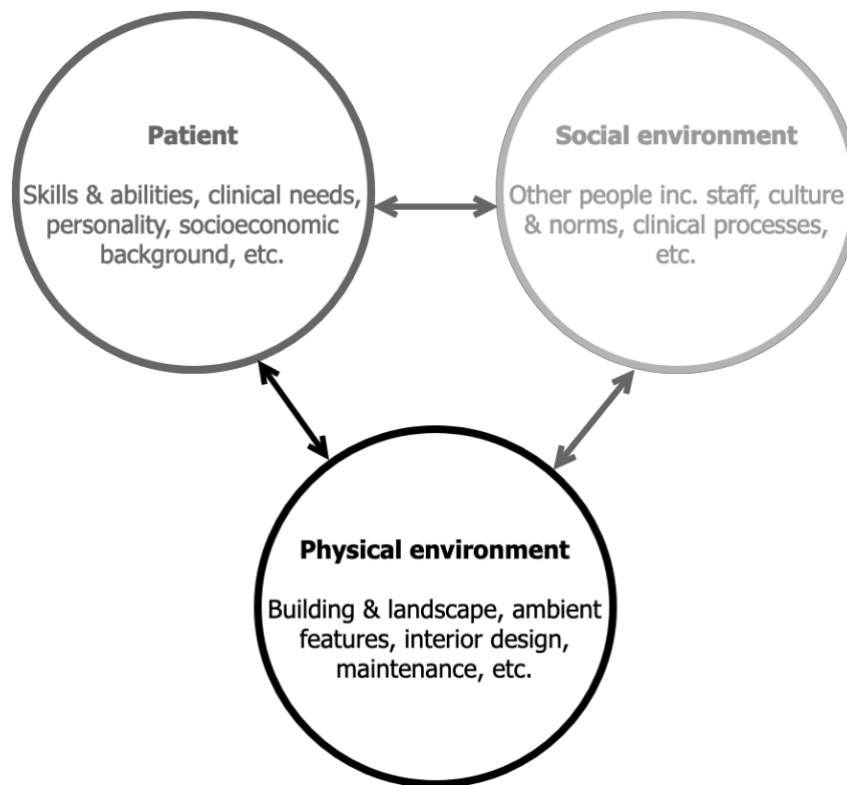


Figure 1.1 A model of the inpatient stroke rehabilitation context.

Inpatient stroke rehabilitation is an interaction between the patient, and the social and physical environments of the rehabilitation facility. This thesis focuses on the physical environment (outlined in black) and its interaction with the patient (outlined in dark grey). The social environment (outlined in light grey) is acknowledged as important but is not the focus of this thesis.

The physical environment includes everything tangible in our surroundings; everything that we can touch, see, hear, smell, or taste. The physical environment might be natural (e.g., trees, sunlight, birdsong), built by humans (e.g., a room, curtains, alarm sounds), or a combination of the two (e.g., sunlight through a window). Importantly, other people are not considered part of our physical environment; rather, they are part of our social environment. The social environment includes the people in the space, the way they interact with each other, spoken or unspoken cultural and social norms, policies and procedures, and social structures that

govern human behaviour. In this thesis, the physical environment and social environment are considered separate but inextricably linked concepts (as depicted in Figure 1.1). Changing the physical environment may influence the social environment, and vice versa.

In the context of healthcare buildings, Harris et al. (2002) have divided the physical environment into four categories:

- 1) ambient features (e.g., noise, air quality, odours, light, and temperature);
- 2) architectural and landscape features (e.g., position and layout of the building, relationship between the building and its surroundings, dimensions of a room, placement of doors and windows, views, and outdoor areas);
- 3) interior design features (e.g., furniture, artwork, signage, colours, equipment, and technology); and
- 4) maintenance and housekeeping (e.g., cleanliness, repair and upkeep of architectural and interior features)

This definition of the physical environment highlights the sheer number of variables, or features, that could be worthy of attention in the study of inpatient stroke rehabilitation facilities.

Kurt Lewin is credited with being the first to describe human behaviour as a function of both the person and their environment (1936). Lewin expressed this function in a general formula: $B = f(P, E)$, where B = behaviour, P = person, and E = environment (1936). Lewin's theory of human behaviour has been the basis of many subsequent theories of person-environment interaction, some of which have informed healthcare environments research (Pati & Barach, 2010; Stichler & Hamilton, 2008b).

Having said this, there is no overarching theory of environmental psychology; the relative lack of data and the variety of methods, settings, and disciplines in the field have made it difficult to create a unifying theory (Devlin, 2018). A recent scoping review of theory in healthcare environments research revealed variation in the type and application of theories and did not identify any theories specific to rehabilitation environments (Shannon, Nordin, Bernhardt, & Elf, 2020). While no theory is perfectly suited to rehabilitation environments, general theories of person-environment interaction, such as Behaviour Setting theory and Person-Environment Fit theory, may help to inform our understanding of how the physical environment might support (or hinder) patient behaviour and emotional well-being in stroke rehabilitation.

1.3.1 ***Behaviour Setting theory***

Early researchers in environmental psychology proposed that there are specific, identifiable environments – called behaviour settings – in which the physical and social environments are inextricably linked, and that these settings have a powerful influence on human behaviour (Barker, 1968; Scott, 2005; Wicker, 1968). The physical and social environments of a health practitioner’s waiting room, for example, combine to ensure that the people who are waiting all behave in a similar way. The rows of chairs (physical environment) prompt them to sit down, and social norms encourage them to be quiet. According to this theory, people may behave quite differently in a waiting room with a different layout or different furniture, and they also may behave quite differently in a waiting room without other people present.

Behaviour Setting theory is useful because it acknowledges that the physical and social environments are linked, and that they both influence behaviour, which is consistent with the definition of the physical environment used in this thesis (see

above). According to this theory, rehabilitation patients' behaviour may change if they are taken out of the healthcare behaviour setting. Most rehabilitation facilities do include settings that are designed to encourage physical activity, namely the therapy areas and gym. However, these spaces are often off-limits to patients outside of their assigned therapy time (Janssen et al., 2014b), creating a lack of autonomy and control. In addition, design choices that support physical activity do not necessarily extend to the rest of the rehabilitation facility where unstructured, incidental, or patient-initiated skills practice might occur. A study comparing patients' physical activity levels in different Norwegian stroke units found that patients admitted to hospitals that had a policy of serving meals in a communal dining area, rather than in the patient bedroom, were more physically active (Hokstad et al., 2015). Providing communal spaces, and encouraging patients to visit these spaces, may lead to incidental increases in physical activity. It could be useful to consider how the current behaviour setting of rehabilitation facilities might be encouraging inactivity, boredom, stress, and other detrimental internal states and behaviours. This will be discussed further in Chapter 3.

1.3.2 ***Person-Environment Fit theory***

Behaviour Setting Theory does not give much weight to how internal, or personal factors (in the 'patient' circle in Figure 1.1) may influence how a stroke patient interacts with their environment and the subsequent behaviours they display. To properly explore the role of the physical environment in stroke rehabilitation, both the internal (person) and external (environment) need to be considered. Put simply, Person-Environment Fit theory describes how a person's "competence" together with "environmental press" or demand of their surroundings influence the person's behavioural and emotional response to their environment and ultimately determine

their extent of engagement, or lack thereof, in the setting, see Figure 1.2 (Lawton & Nahemow, 1973).

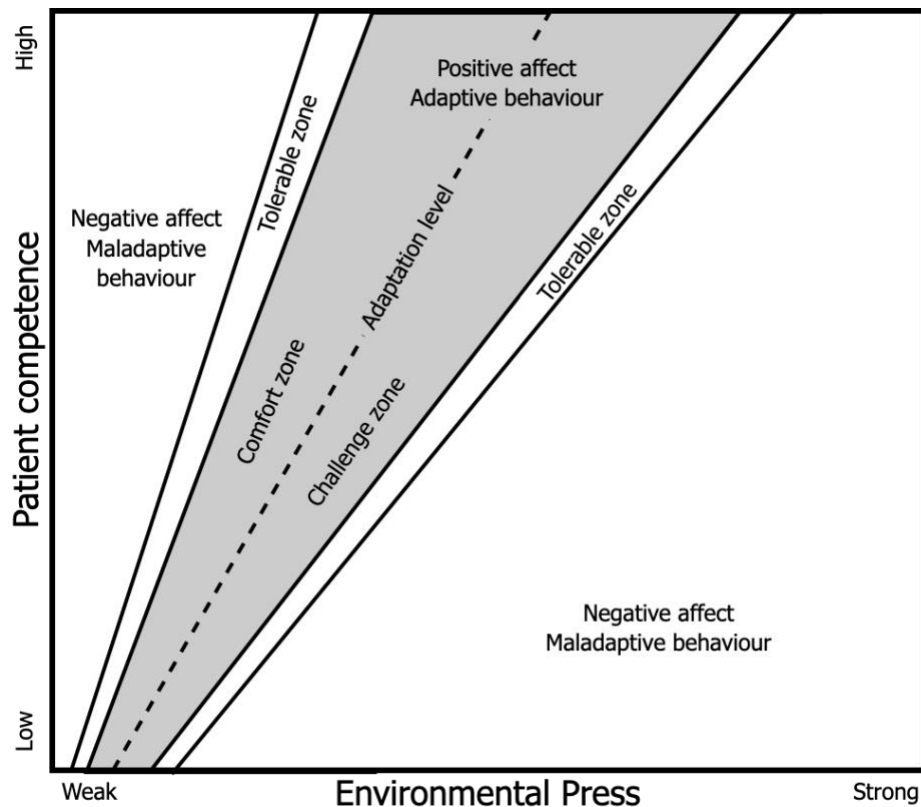


Figure 1.2 Person-Environment Fit theory

The fit between a person's competencies and the demands in the environment (environmental press) influence the person's behavioural and emotional response to their environment. Figure is adapted from Lawton and Nahemow (1973, p. 661).

Person-Environment Fit theory was initially developed to describe the relationship between older people and their environments (Lawton & Nahemow, 1973; Lawton & Simon, 1968). It is therefore often used in studies of aging and the environment, including studies of residential aged care facilities, aging in place, and dementia (Lee, Chaudhury, & Hung, 2015; Park, Han, Kim, & Dunkle, 2017; Pomeroy et al., 2011; Rantakokko, Törmäkangas, Rantanen, Haak, & Iwarsson, 2013; Resnick, Galik, Gruber-Baldini, & Zimmerman, 2010). Overall, it is one of the more

frequently utilised theories in healthcare environments research (Shannon et al., 2020). It was proposed as a useful theory for rehabilitation environments research over 20 years ago by the research architect Bettye Rose Connell (1997). Unlike Behaviour Setting Theory, Person-Environment Fit theory applies equal importance to both the person and their environment, and suggests that a patient's competencies (clinical and personal characteristics) interact with the environment to influence the patient's behaviour and emotional well-being.

Person-Environment Fit theory is sometimes referred to as the General Ecological Model, the Environmental Press Model, or the Competence-Press Model. In this theory, "competence" refers to the characteristics of the person: their comorbidities, skills, abilities, etc. – everything that makes each stroke patient different from the next. "Environmental press" refers to the demands or supports that a person perceives to be placed on them by the environment in the context of a particular action or task. These environmental presses are themselves neutral but become positive or negative when they interact with a person's competencies.

In the context of stroke rehabilitation, an action such as walking from the bedroom to the gym requires many competencies, including lower limb function and balance, visual acuity, spatial awareness, and memory. The environmental press associated with that action comprises all the demands or supports created by the physical environment (e.g., distance to the gym, floor surface, handrails, light reflection, etc.) and to some extent the social environment (e.g., prompts from staff, number of other people making the same journey, etc.). If there is a lack of fit, or mismatch, between a person's competencies and the environmental press then the person will display negative affect and maladaptive behaviours. For example, a person who fatigues easily may experience a lack of fit if the distance to the gym is

too great; they might fall or fear falling, revert to using a wheelchair, feel frustrated or disempowered, or choose not to make the journey at all. This example describes a mismatch where the environmental demands exceed the person's capabilities (strong environmental press, low competence) leading to negative affect and maladaptive behaviour. Importantly, negative affect and maladaptive behaviours may also occur if the person's competencies exceed the environmental demands (low environmental press, high competence).

The “adaptation level” in Figure 1.2 describes the point at which there is an exact fit between the person's capabilities and the environmental press. If environmental press becomes slightly higher than a person's adaptation level, then the person can meet the challenge and experience positive reinforcement, motivation, and learning (Lawton & Nahemow, 1973; Nahemow, 2000; Scheidt & Norris-Baker, 2003). This is referred to as the “zone of maximum performance potential” or the “challenge zone” (Lawton & Nahemow, 1973; Nahemow, 2000). If environmental press is slightly lower than the adaptation level, then the person can feel relaxed and comfortable, but may not be challenged or motivated enough to act. People with low competence have less tolerance for environmental press (i.e., a narrower zone of positive affect and adaptive behaviour), while people with high competence can tolerate more variability in their environments. This theory and how it relates to stroke rehabilitation will be detailed further in Chapters 4 to 7.

1.4 Overview of relevant healthcare environments literature

Although few studies specific to stroke rehabilitation environments were published prior to 2016 (see Section 1.1.3), some recent studies have begun to address the topic of rehabilitation environments more broadly (Anåker, von Koch, Heylighen,

& Elf, 2019; Anåker, von Koch, Sjöstrand, Bernhardt, & Elf, 2017; Anåker, Von Koch, Sjöstrand, Heylighen, & Elf, 2018; Blennerhassett, Borschmann, Lipson-Smith, & Bernhardt, 2018; Colley, Zeeman, & Kendall, 2018; Kevdzija & Marquardt, 2018; Killington et al., 2019; Simpson, 2018). These studies, and literature from other healthcare settings, may inform our understanding of how the physical environment could support patients' behaviour and emotional well-being during stroke rehabilitation. In particular, patient-centred environments, enriched environments, and salutogenic environments are each discussed in the following sections.

1.4.1 ***Patient-centred environments***

The concept of patient-centred care acknowledges variability in patients' needs and strives to arrange their care accordingly. While there is no standard definition of patient-centred care, some generally accepted components are: patient involvement in care, patient empowerment, and adapting care to suit the patient (Leplege et al., 2007; Scholl, Zill, Harter, & Dirmaier, 2014). Patient-centred care has been touted as important to the design of hospitals since the early days of evidence-based healthcare design (Devlin & Arneill, 2003). The idea of patient-centred design draws on environmental psychology research about the influence of the physical environment on an individual's capacity for self-directed, free choice (Proshansky, Ittelson, & Rivlin, 1972). Indeed, the well-established Planetree model of patient-centred care was founded in the 1970's on the principles of providing more positive, less stressful, care within hospital environments (Martin, Hunt, Conrad, & Hughes-Stone, 1990). Holmqvist and von Koch have similarly argued that the hospital environment de-motivates patients by removing their autonomy and initiative (Holmqvist & von Koch, 2001). Over the past two decades, there have been attempts to design rehabilitation facilities according to a patient-centred philosophy, such as

the Shirley Ryan AbilityLab in Chicago, USA, but there has been limited research to determine exactly what a patient-centred design might look like or the impact this design may have on the rehabilitation process or indeed on patient outcomes.

Patients need to feel motivated to participate and need to feel empowered to direct their own practice and activity (see Section 1.2.2). In relation to the physical setting, patient control over their environment is an important component in patient-centred practice (Devlin & Arneill, 2003; Ulrich, 1992). Patients have long reported having very little control over aspects of the hospital environment such as noise, lighting, temperature, and privacy (Steptoe & Appels, 1989) – all of which may also negatively affect patients' sleep (Salonen et al., 2013). Interventions such as single-bed rooms have been suggested as possible solutions to the noise problem, and to give patients more control and sense of ownership over their environment in acute settings (Ulrich et al., 2008; Wang et al., 2013), but these solutions have produced mixed results and may not be appropriate in rehabilitation. For example, single-bed rooms in a rehabilitation facility may decrease patients' levels of social interaction and activity, or increase their falls risk (Bernhardt & Cumming, 2013; Shannon et al., 2018).

Suitable wayfinding may help patients to perceive more control over the physical environment of the hospital (Salonen et al., 2013). Hospitals can be incredibly large and confusing places, making wayfinding an essential tool for patients to gain understanding of the space (Carpman & Grant, 2016; Devlin, 2014). Wayfinding may be influenced by environmental elements beyond signage or directions. For example, open plan layouts can increase visibility and orientation. Architectural features, artwork (e.g., painting, sculpture, etc.), and furniture can form distinctive landmarks that help patients maintain command of the space (Pati, Harvey, Willis, & Pati, 2015). However, a patient can only gain a sense of control and benefit

from their knowledge of the layout of a rehabilitation facility if they can easily access the spaces within it. As mentioned above, many areas on and off the ward are often kept locked and off-limits to patients (see Section 1.3.1). The issue of access is frequently countered by the issue of safety, with some rehabilitation staff concerned that patients risk injury if they are encouraged to independently explore the environment (Luker et al., 2015). Safety risks associated with freedom of movement and independent access should be weighed up against the potential benefits to the patient, including empowerment, practice and activity. While a self-directed approach is recommended in rehabilitation, some stroke patients will be unable to set their own goals or direct their own behaviour due to the nature of their brain injury, and all patients will need at least some guidance from staff. Rehabilitation facility design must therefore support both independent and supervised learning and consider the needs of both the patients and the staff. While it is not a specific focus of this thesis, the importance of the staff's experience is acknowledged as part of the whole, complex rehabilitation system (see Chapter 3 in particular).

1.4.2 ***Enriched environments***

An enriched environment may be beneficial to the stroke rehabilitation process in humans (Janssen et al., 2010). An environment is said to be enriched if it provides a combination, or 'package' of opportunities for social interaction, physical activity, and sensory, motor, and cognitive stimulation and thereby promotes experience-dependent neuroplasticity (McDonald, Hayward, Rosbergen, Jeffers, & Corbett, 2018). Environmental enrichment was originally considered in the context of animal research by Donald Hebb who showed that laboratory rats who were free to run about his home acquired better learning and problem solving skills than rats kept in standard laboratory housing (1947). Since then, studies of many different models of

neurological conditions and brain injury have repeatedly shown that animals in an enriched enclosure exhibit increased physical activity, physical and cognitive function, learning, and neuroplasticity compared to animals in standard housing (Nithianantharajah & Hannan, 2006). Enriched animal enclosures usually include 8-12 animals and a rotating array of novel toys, running wheels, and ramps. Housing animals in enriched environments can delay or prevent the onset of a number of neurological disorders, including hereditary conditions such as Huntington's disease (van Dellen, Blakemore, Deacon, York, & Hannan, 2000), and can aid in brain repair and functional recovery after stroke (Janssen et al., 2018; Ohlsson & Johansson, 1995).

In recent years, several authors have investigated the feasibility and efficacy of applying the principles of environmental enrichment with human stroke patients (and acute settings Janssen et al., 2014b; Khan et al., 2016; Rosbergen et al., 2017). Janssen and colleagues developed a protocol for applying environmental enrichment in an existing inpatient rehabilitation setting (Janssen et al., 2012)(Janssen et al., 2012)(Janssen et al., 2012)(Janssen et al., 2012)(2012). Participants were provided with individual enrichment activities of their choice (e.g., music, books, magazines) and a 'communal enrichment area' was allocated to the study, complete with computers, games, books, and a dining room. Participants were encouraged to utilise the activities, but all use was voluntary and self-initiated. Participants in the enriched environment were observed to participate in more cognitive and social activities, and be awake for more hours during the day than those in a non-enriched environment. However, observed physical activity was not significantly different (Janssen et al., 2014b). Janssen and colleagues recently completed a larger phase II trial in four rehabilitation centres following the same

protocol (Australian New Zealand Clinical Trials, anzctr.org.au, ACTRN12613000796785). The results are yet to be published.

Although animal research has repeatedly shown benefits of environmental enrichment, whether the model can successfully be translated to stroke survivors is unknown. We currently lack understanding of the exact mechanisms by which environmental enrichment promotes neuroplasticity in animals, and, related to this, it is unclear which components of the enrichment ‘package’ are most important. It is therefore difficult to determine the human equivalent of an enriched animal enclosure (McDonald et al., 2018). Further research is needed to establish the most appropriate human enrichment interventions and the extent or ‘dose’ at which they should be delivered (Reid, Ng, & Khan, 2016).

Thus far, the environmental enrichment model in humans has relied on adding access to tools and materials (e.g., music, books, games, etc.) in an existing building and on staff to encourage patients to use them. An enriched environment for humans could perhaps be conceptualised on a larger scale as one that permeates the physical environment more broadly so that the building itself encourages physical, cognitive, and social activity. Stroke patients have identified the “depressingly unstimulating” ward environment as one of the things that negatively affects their motivation to practice whilst in rehabilitation (Maclean et al., 2000, p. 1053). The concept of a stimulating physical environment has been taken to the extreme by artist and architect duo Arakawa and Madeline Gins who designed and built ‘reversible destiny houses’ in which the layout is unexpected and challenging for the user. While the effect of these environments has not been measured, Arakawa and Gins believed that a cognitively challenging environment would lead to physical and cognitive benefits for the inhabitants (Arakawa & Gins, 1994). This approach, and others like it, is

intriguing but likely inappropriate for people with brain injury, where a relentlessly stimulating and unpredictable environment would be too challenging for most individuals.

1.4.3 ***Stress-reducing environments***

Fox and Harrison have argued that certain environmental interventions, such as environmental enrichment, may be effective in a general sense as they promote neuroplasticity and attenuate the negative impact of stressful situations (Fox, Merali, & Harrison, 2006). Natural environments and green spaces, for example, offer a complex, ever-changing sensory experience and may be an inherently stimulating yet calming space – indeed, nature is the enriched environment in which humans evolved (Janssen et al., 2018). Ulrich has long argued that natural environments, views of nature, or artworks depicting nature reduce patient stress (1983). In a landmark retrospective study, he emphasised the importance of windows and pleasing views by showing that surgical patients assigned to a hospital room with a window overlooking a tree recovered more quickly and required less pain medication than those in a room with views of a wall (Ulrich, 1984). A later study in a (non-neurological) rehabilitation context similarly found that patients with an unobstructed view of natural surroundings had better self-reported mental health (Raanaas, Patil, & Hartig, 2011). However, this study also found that patients with a view were more likely to spend time in their bedrooms (Raanaas et al., 2011), and may therefore have participated in less incidental physical activity.

Ulrich has suggested that patients will feel less stressed if they have positive distraction (e.g., art, nature, aesthetically pleasing spaces, etc.), social support (e.g., presence of other people), and if they feel they have control of their environment (e.g., familiar environment, control over light, temperature, etc.) (Ulrich, 1991, 1992,

2001). Andrade et al. tested this theory in an acute hospital setting and found that patients' stress was indeed mediated by the positive distraction and social support they perceived in the environment, but was not mediated by perceived control (Andrade & Devlin, 2015; Andrade, Devlin, Pereira, & Lima, 2017).

Positive distraction, social support, and perceived control may do more than just reduce stress in the context of stroke rehabilitation. While stress reduction is important in stroke rehabilitation, it is not the only important thing. Indeed, according to the general stress literature, some degree of managed stress is considered useful for activity and learning as opposed to distressing (Rudland, Golding, & Wilkinson, 2020). As mentioned above, personal sense of control may be important for patients' empowerment and participation in rehabilitation, and the positive distractions and social interaction in an enriched environment appear to be important for promoting activity. According to Person-Environment Fit theory, it could be beneficial for the environment to challenge stroke patients just enough to promote activity and learning, which suggests that being entirely content might not be beneficial. Healthcare design that actively promotes positive patient wellbeing while reducing negative experiences such as stress and anxiety is often referred to as salutogenic or psycho-supportive design (Dilani & Armstrong, 2008). Broadly based on Antonovsky's Sense of Coherence model (1979), psycho-supportive design recognises the value of environmental factors that promote wellness and engagement, and facilitate an individual's capacity to deal with negative factors such as stress.

Overall, the relationships between the environment and patients' behaviour and emotional well-being are likely to be complex, at times conflicting (e.g., how can environments be sleep-friendly yet engaging?), and highly individualised for each

patient depending on their competencies and needs. Any study of rehabilitation environments must take this complexity and patients' unique needs into account.

1.5 Research approach and thesis scope

All research is influenced by the philosophical assumptions held by researchers. These worldviews guide researchers to address particular questions, use particular methods, and infer particular results in their research (Creswell & Plano Clark, 2018; Lincoln, Lynham, & Guba, 2011). The approach taken in this thesis is informed by the post-positivist philosophical paradigm of pragmatism. Pragmatists recognise that there is no ultimate truth, only provisional truths, and as such they are focused on workable, practical solutions to real-world problems (Creswell & Plano Clark, 2018; Johnson & Onwuegbuzie, 2004; Patton, 2015; Ritchie, Lewis, Nicholls, & Ormston, 2014). A pragmatist considers knowledge to be both: 1) based on the reality of the world (external) and 2) constructed by human experiences (internal) (Johnson & Onwuegbuzie, 2004). The pluralism of pragmatism has led a number of scholars to propose it as the natural philosophical paradigm for mixed methods research (Creswell & Plano Clark, 2018; Datta, 1997; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 1998; Teddlie & Tashakkori, 2003). In this thesis, mixed methods were used, and an applied and interdisciplinary approach was taken. Practitioners in healthcare and design have been involved throughout (see Preface section on page v, and Chapter 3).

1.5.1 *The challenge of researching complex systems*

Healthcare environments are complex, multifactorial systems. Patients' needs are varied and complex; the physical environment is complex; and the social

healthcare environment is complex – people have competing needs, there are intricate clinical hierarchies, and many policies and procedures that must be followed at the level of the patient, hospital, and state and federal governing bodies. The interdependencies between the physical environment, the social environment, and the patient present a challenge for traditional scientific approaches of isolating variables and identifying causation (Stichler & Hamilton, 2008a).

Most stroke rehabilitation research simplifies and controls this complex system in order to investigate aspects of it, particularly clinical processes, and the interaction between these and the patient and their recovery. Such studies test clinical interventions and models of care, search for clinical predictors of recovery, and inform the clinical guidelines for stroke rehabilitation (Stroke Foundation, 2019). Research of that kind is essential, but it often does not address the wider context of stroke rehabilitation, or the physical environment in which rehabilitation takes place.

Rehabilitation environments is a new field of research (see Section 1.1.3). There is not yet a clear understanding of which research questions are most important, or the key variables involved. Research methods that focus on hypothesis testing could run the risk of addressing the wrong problem, testing the wrong variables, or being affected by confirmation bias. This thesis addresses the physical environment of inpatient stroke rehabilitation environments and how it interacts with patients and their care, while acknowledging that this is just one aspect of the whole, complex stroke rehabilitation system.

1.5.2 *An exploratory approach is appropriate for rehabilitation environments research*

Complex systems are defined as systems with many components that interact in unpredictable ways (Kauffman, 1996; Waldrop, 1992). Complex systems may be

biological systems, computer systems, economic or social systems. Healthcare systems are a classic example of a complex system (Kernick, 2006; Klein & Young, 2015; Long, McDermott, & Meadows, 2018; Plsek & Greenhalgh, 2001). Pragmatism has been put forward as a useful paradigm for researching complex healthcare systems (Long et al., 2018). All complex systems have particular features in common, which I have summarised into three main points.

Firstly, they are comprised of many interacting agents. These agents may be people, or cells, or lines of computer code depending on the nature of the system in question. Rehabilitation environments are comprised of many interacting agents (some of which are listed inside the circles in Figure 1.1). Secondly, complex systems are constantly shifting and adapting in response to the interactions between these agents. In this way, the system continually undergoes “spontaneous organisation” (Waldrop, 1992, p. 11). There is no one agent in charge, but each agent is an active and adaptive part of the system, just as stroke rehabilitation patients must be active agents in their recovery post-stroke. Thirdly, because the system depends on so many intricate interactions, it is extremely difficult to predict the outcome of any given change to the system.

Every aspect of a complex system is important and interconnected (Holland, 2014). Complex systems are therefore best understood when the system is observed as an integrated whole, without attempts to control or simplify any aspect of it (Byrne, 2002; Byrne & Callaghan, 2013). The connections and interdependencies between the person and the environment (i.e., between the many internal and external interacting agents in the system) can only be identified if they are observed in context. This thesis will therefore embrace the complexity of the stroke rehabilitation environment system and view the physical environment comprehensively within this system. No attempt

will be made to simplify by isolating or testing individual variables. Instead, the focus will be on exploring and describing the role of the physical environment in the context of the stroke rehabilitation process.

An exploratory approach is best when little is known about a topic, the topic appears complex, or suitable research methods are yet to be defined (Babbie, 2015). The topic of stroke rehabilitation environments meets all of these criteria. As with all research that is conducted in the field, it is difficult to control, isolate, and test specific variables. Mixed methods and exploratory research methods, such as case studies or case-comparisons, are recommended for researching complex systems in the social sciences (Byrne, 2002; Byrne & Callaghan, 2013). Other researchers who have approached healthcare as a complex system have chosen to use such methods (Anderson, Crabtree, Steele, & McDaniel Jr, 2005; Long et al., 2018). This thesis can be viewed as the exploratory first step in the scientific process to understand the role of the physical environment in stroke rehabilitation (see Figure 1.3).

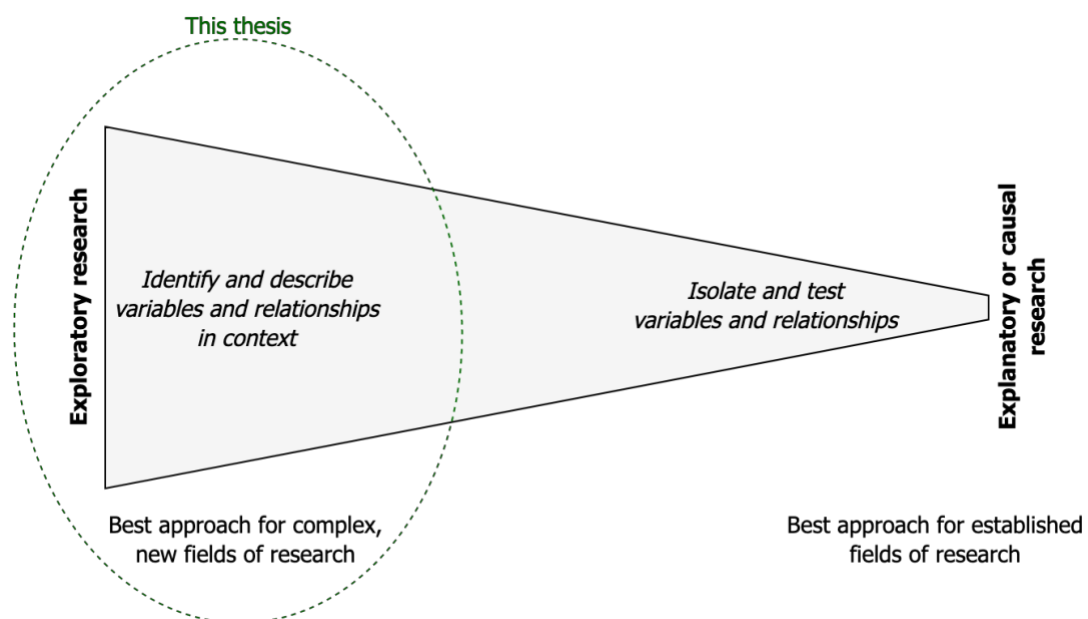


Figure 1.3 The scientific spectrum from exploratory to explanatory research

This thesis takes an exploratory approach.

1.5.3 ***The use of theory in this thesis***

The pluralism of pragmatism suggests that no research can be purely inductive or purely deductive; all research should be reflexive and refer to past research and theories, but also remain flexible and informed by new data (Blaikie, 2007; Ritchie et al., 2014). Theories are useful for organising information and explaining observations (Neuman, 2014). The exploratory approach and real-world observations in this thesis were expected to generate a large amount of information. Theory is therefore used in two ways in this thesis: 1) to inform the rationale and research questions, and 2) to organise the large amount of data and guide the interpretation of results. The data that are collected will be treated inductively, allowing the data to speak for themselves, but theory will be considered again in the final interpretation of these data. This two-pronged approach to using theory is referred to as an inductive interpretive approach (Creswell, 2016).

While there is no theory that is specific to rehabilitation environments, as identified earlier, Person-Environment Fit theory has the benefit of acknowledging both the internal (person) and external (environment) factors in emotional well-being and behaviour, which is central to the topic of stroke rehabilitation environments and reflects the worldview of pragmatism. Person-Environment Fit theory will underpin this thesis, both inductively and interpretively, particularly in Study 3 (Chapters 4 to 7). Behaviour Setting theory will also be referred to in this thesis, but to a lesser extent; specifically, it contributed to the rationale in Study 2 (Chapter 3).

1.6 Aims

The primary aim of this thesis is to explore the role of the physical environment in inpatient stroke rehabilitation as it relates to patient recovery. This aim will be addressed via two subsidiary aims, which are:

- 1) Describe how the physical environment of inpatient rehabilitation facilities supports, or could support, the process of learning and recovery post-stroke, i.e., identify the elements in the physical environment that are important for learning and recovery after stroke, and identify how these environments are, or could be, fit for the purpose of stroke rehabilitation.
- 2) Explore the relationships between internal (patient) and external (physical environment) factors in post-stroke inpatient rehabilitation.

A secondary aim of this thesis is to explore different methods and measures for researching these environments.

Each of the studies in this thesis will be governed by specific research questions, all of which address the above aims. These research questions will be articulated in the subsequent chapters as each of the studies in this thesis is introduced.

1.7 Thesis outline

This thesis consists of three exploratory studies which collectively contribute to the thesis aims. Chapter 2 contains the published manuscript of Study 1, which was a survey of inpatient rehabilitation facilities in Victoria, a state of Australia. This survey addressed the question of what the physical environment is like in the inpatient

rehabilitation facilities in Victoria, e.g., when were they built and whether they were purpose-built. The results of this survey provide an overview of the current physical environments of rehabilitation spaces; including some of the external factors that may play a role in influencing patients' behavior and emotional well-being. The survey revealed significant heterogeneity in the physical environments of inpatient rehabilitation facilities.

Given this heterogeneity, Study 2 was driven by the question of what, in an ideal world, all inpatient stroke rehabilitation facilities should have in common in order to fit the purpose of rehabilitation. This question was addressed via expert elicitation workshops, which are described in the published manuscript in Chapter 3. The workshop participants produced a framework of what is important in the physical environment of inpatient rehabilitation facilities to support the stroke rehabilitation process.

Chapters 4 to 7 report the methods and results of Study 3, which was a convergent mixed methods multiple-case study of two inpatient rehabilitation facilities. This multiple-case study explored the internal (patient) and external (physical environment) factors in two rehabilitation facilities and addressed the question of patients' experience of the physical environment in rehabilitation, and the nature of their behaviour, emotional well-being, and safety in these spaces. Four themes were identified from interviews with patients, which describe their experience of being in the inpatient rehabilitation environment (reported in Chapter 5). The quantitative results from the multiple-case study describe patients' behavior, emotional well-being, and safety in these physical environments (reported in Chapter 6). In Chapter 7, the qualitative and quantitative results are merged using convergent mixed methods to produce a conceptual model of the role of the physical environment

in stroke patients' behavior, emotional well-being, and safety in rehabilitation. The final chapter of this thesis, Chapter 8, provides an overview and discussion of the three studies, their contributions to the thesis aims and the field more broadly, strengths and limitations, and final conclusions.

2 Study 1: Survey of rehabilitation facility buildings

2.1 Chapter overview

This chapter contains Study 1 of this thesis; a descriptive survey of the inpatient rehabilitation facility buildings in Victoria, Australia. The first section provides a rationale for this study in the context of this thesis. Section 2.3 contains the published manuscript of Study 1. Section 2.4 provides a summary of the implications of this study. The ethics approval for Study 1 and the supplementary material for the manuscript can be found in Appendices 2 and 3 respectively.

2.2 Study rationale

A necessary early step for all exploratory research is to become familiar with the topic (Babbie, 2015). The overview of the literature in the previous chapter began this process of familiarisation, however, this thesis is not just grounded in previous research; it is also grounded in the physical world, specifically inpatient rehabilitation facilities. Familiarity with the topic therefore depends on familiarity with these physical spaces. This survey helped me to understand the current state of rehabilitation facility design in Victoria.

Prior to confining this survey to the state of Victoria, the number of inpatient rehabilitation facilities in the whole of Australia was estimated following the same steps outlined in the methods section of the published manuscript in this chapter. This revealed 304 inpatient rehabilitation facilities in Australia (180 public and 124 private). Considering the large number of facilities in Australia, the survey was

confined to one state. This allowed the study's limited resources to be put towards data quality (response rate, data completeness) rather than data quantity.

The state of Victoria was chosen for a number of reasons. I was based in Victoria during my PhD research and planned to visit a targeted shortlist of rehabilitation facilities after completing the survey (see Section 4.5, Chapter 4), so proximity was a necessary consideration. Victoria is the second most populous and the fastest growing state in Australia with a population of 6.5 million people (Australian Bureau of Statistics (ABS), 2019). According to my survey, it has more rehabilitation facilities than any other state except New South Wales, which is the most populous state. The vast majority of Australians live in large, coastal cities, and there is a challenge across the country to provide healthcare to rural and regional areas. This national pattern of population density is mirrored in Victoria, albeit minus the extreme remoteness of some areas in the centre of the country (as noted in the discussion section of the manuscript).

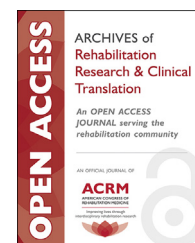
The Australian healthcare system is a hybrid model, comprising both public and private systems (Willis & Parry, 2012). The public system is entirely funded by the government and provides full access to basic, essential services for all residents. The private system is privately funded by independent healthcare providers, some of which are historically affiliated with religious organisations. Individuals can choose to purchase private health insurance or pay out-of-pocket to access the private system. Both public and private facilities were included in the survey of rehabilitation facilities in order to be representative of the Australian system.

Although the focus of this thesis is stroke rehabilitation, this survey was not limited to stroke rehabilitation specialist facilities since in Australia it is common for stroke rehabilitation to take place in a general rehabilitation facility (Stroke

Foundation, 2018). General rehabilitation facilities might include people recovering from neurological injury or diseases (including stroke), orthopaedic surgeries, cardiac events, and many other conditions besides. Including all inpatient rehabilitation facilities in the survey provided a more representative picture of the types of physical environments that stroke patients may be exposed to. Survey respondents were asked to briefly describe their patient cohort so that facilities with few stroke patients, and those with many stroke patients could be identified. This information was used to create the shortlist of potential cases for Study 3 (see Chapter 4).

2.3 Publication

Lipson-Smith, R., Zeeman, H., & Bernhardt, J. (2020) What's in a building?: A descriptive survey of adult inpatient rehabilitation facility buildings in Victoria, Australia. *Archives of Rehabilitation Research and Clinical Translation*.



Original Research

What's in a Building? A Descriptive Survey of Adult Inpatient Rehabilitation Facility Buildings in Victoria, Australia



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KEYWORDS

Built environment;
Evidence-based
facility design;
Hospitals,
rehabilitation;
Patients' rooms;
Rehabilitation;
Rehabilitation
centers

Abstract *Objective:* To identify all the services that offer inpatient rehabilitation in Victoria, Australia, and to describe the buildings in which these services are housed, including their size, age, whether or not they were purpose-built, whether or not they are colocated with a tertiary hospital, the proportion of single-bed rooms, and ward layout.

Design: Cross-sectional survey of inpatient rehabilitation buildings. Data were collected via telephone questionnaire and websites.

Participants: Sixty-four rehabilitation facilities were identified and all participated in the survey (37 public, 27 private).

Results: Results revealed heterogeneity on most variables measured, including size (number of beds ranged from 2-104), age (oldest building built in 1860, and 26% built since 2010), purpose-built status (48% purpose-built), freestanding status (34% freestanding), percentage of single-bed rooms (ranged from 0%-100%), and layout. All facilities had a therapy gym, and most had a communal area (96%).

Conclusion: Since 2010, the proportion of buildings being purpose-built and colocated with a tertiary hospital has increased. The proportion of single-bed rooms has also increased and is especially high in privately funded facilities. Results suggest that rehabilitation design is influenced by norms and evidence from acute medical health care despite the purpose of care

List of abbreviations: AROC, Australasian Rehabilitation Outcomes Centre; IQR, interquartile range.

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being different: acute care (short-term, medical illness) and rehabilitation (longer-term, recovery, relearning).

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The built environment can affect our behavior and well-being, and thus hospital buildings can affect clinical efficiency and outcomes.¹ The design of rehabilitation facilities has been largely overlooked in health care design research, with most research focusing on acute health care environments.^{2,3} This article concerns built environment design for inpatient physical, cognitive, or occupational rehabilitation following illness or injury, not drug or alcohol rehabilitation.

Clinical priorities in rehabilitation differ from those in acute health care. While in rehabilitation, patients must balance rest with active participation in repetitive, goal-directed practice to relearn skills and abilities.^{4,5} Rehabilitation patients' needs vary considerably depending on type of injury or illness, but in general, physical, cognitive, and social activities are important for regaining independence. Length of stay is usually longer in rehabilitation than in acute care. The optimal design for rehabilitation buildings may therefore be different from that of acute health care and requires detailed insight into the needs of varied rehabilitation patient groups. For example, although single-occupancy patient bedrooms are increasingly considered best practice for acute health care, there is debate about whether they are the most appropriate choice for all patients.^{6,7} The demand for rehabilitation care is increasing as our population ages and acute treatment improves.⁸ It is therefore timely to ask whether rehabilitation facilities are designed to meet the unique needs of rehabilitation patients.

To date, there has been no survey of rehabilitation facility buildings in Australia. Graham and Cameron conducted an Australia-wide survey to establish the availability of rehabilitation, but did not collect data regarding the buildings.⁹ From 2008-2012, the Rehabilitation Services Report conducted by the Stroke Foundation included 2 questions regarding the built environment: (1) whether the facility was freestanding or part of an acute hospital; and (2) whether certain spaces were available (therapy gym, dining room, etc).¹⁰ The Rehabilitation Services Report is an excellent summary of service performance for stroke rehabilitation in Australia, but it has provided limited information about the built environment. Knowing that there is a therapy gym available to patients does not indicate how easily accessible this gym is from the ward. Is it in a separate building? On a different floor? Participation in the Report is voluntary, specific to stroke, and dominated by public hospitals, which affects the sample. Twenty-seven Victorian rehabilitation facilities participated in the 2012 Report (25 public and 2 private),¹⁰ which represented 47% of those currently on the national rehabilitation medicine clinical registry of Australia and New Zealand (96% of public and 7% of private).¹¹

The Australian Hospital Design Guidelines does include recommendations for rehabilitation design, but these hardly differ from the Guidelines' recommendations for acute health care besides suggesting that therapy spaces should be made available.¹² There are very few evidenced-based recommendations for rehabilitation design in the Guidelines, which is understandable considering the limited literature available. Research in the area has been stymied on a number of fronts: (1) there are very few suitable theoretical frameworks to draw on,¹³ (2) there are no standard checklists or measurement tools for assessing the design of rehabilitation buildings, and checklists developed for other buildings may not be appropriate,¹⁴ and (3) there is no central repository for hospital designs, which creates a data accessibility problem. Design briefs and floor plans remain in the hands of design and construction teams—even designs for public hospitals are often not publicly available.

On noticing the lack of information available on rehabilitation facility buildings, we decided to conduct a survey of these buildings in the state of Victoria, Australia. The aim of this survey was to describe the buildings that house the rehabilitation facilities, including how many beds they provide, whether they are freestanding or part of a tertiary hospital, when they were built, whether they were purpose-built, whether key services such as a gym are easily accessible from the ward, and the extent to which communal spaces and single-bed rooms are available. By describing these buildings, we hope to show the current state of rehabilitation facility design and inform future research priorities.

Methods

This survey was a descriptive study. Data were collected via telephone questionnaire and publicly available websites between January and July 2017. Ethics approval was received from the Architecture, Building, and Planning Ethics Advisory Group at The University of Melbourne (no. 1749537).

Defining the sample

We aimed to include all public and private inpatient facilities that provide inpatient physical, cognitive, and/or occupational rehabilitation services to adults in Victoria, Australia. This included neurologic, spinal injury, orthopedic, cardiac, acquired brain injury, and musculoskeletal rehabilitation among others. The included facilities could be specialist hospitals dedicated only to rehabilitation, large tertiary hospitals with dedicated rehabilitation wards,

Table 1 Information that was collected for each rehabilitation facility in the sample

Variable	Description
Location	
Postcode	Australian postcode of the facility
Remoteness	According to the Accessibility and Remoteness Index of Australia, accessed from the Australian Bureau of Statistics (http://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure)
Funding	
Funding status	Whether the facility is public or private
Size	
No. of buildings	No. of buildings that the rehabilitation facility is housed in
No. of wards	No. of wards dedicated to rehabilitation
No. of beds	No. of beds dedicated to rehabilitation patients
Freestanding	
Freestanding status	Whether the building is freestanding or attached to a larger hospital
Age	
Year built	Year that the rehabilitation building was completed
Year renovated	Year that the rehabilitation building was last renovated (if applicable)
Purpose-built	
Purpose-built status	Whether the building was originally built as a rehabilitation facility
Original purpose	If it was not purpose-built, specify what it was original built for
Layout	
Therapy location	Where the therapy area is located in relation to the rehabilitation ward(s)
Floors	No. of floors/levels in the building allocated to rehabilitation services
Ward layout	Brief description of the ward layout including location of nurses' station
Communal areas	Whether indoor and/or outdoor communal areas are available to patients
Single-bed rooms	The number of single-bed rooms on the ward
Comments	Any other volunteered information about the design of the building

or smaller facilities where rehabilitation patients were placed in mixed wards (ie, wards providing more than 1 service). Facilities with mixed wards were only included if they had beds permanently dedicated to rehabilitation. Mixed wards reflect the reality of some smaller health care

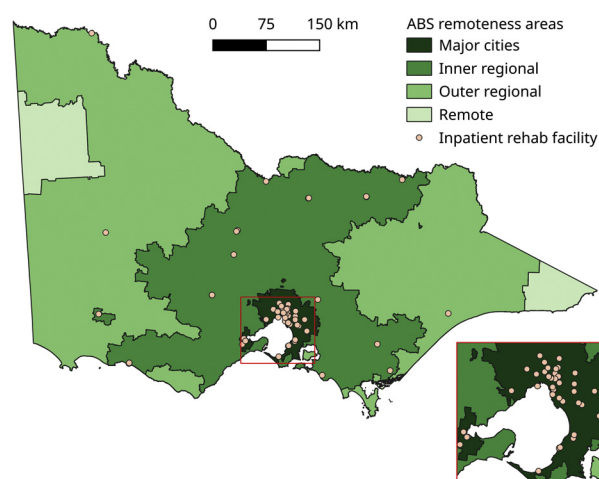


Fig 1 The location of the facilities that provide inpatient rehabilitation in Victoria, Australia, that were included in this survey. The remoteness areas are defined by the Accessibility and Remoteness Index of Australia, accessed from the Australian Bureau of Statistics. Abbreviation: ABS, Australian Bureau of Statistics.

services in Australia, especially in rural areas, and so are an important consideration in any health care survey in this country. Facilities providing exclusively drug and alcohol rehabilitation, only geriatric evaluation and management, only transitional care, only acute care, or only outpatient/community rehabilitation were excluded. Residential aged care facilities were also excluded. For convenience, the included facilities will be referred to in the remainder of this article as rehabilitation facilities, even though some also provide other services besides rehabilitation.

To identify the eligible facilities, we cross-referenced the list of Australasian Rehabilitation Outcomes Centre (AROC) members with the hospitals listed as providing rehabilitation services on the Australian government MyHospitals website. AROC is the rehabilitation medicine clinical registry of Australia and New Zealand. The MyHospitals website provides the public with locations of hospitals, the services they offer, and hospital performance information. We checked these lists against the Victorian health care facilities listed in Schedule 1 of the Victorian Health Services Act 1988.¹⁵ Each facility's eligibility was confirmed via telephone when we called the facility to administer the survey. We verified the completeness of the sample by asking each facility to list the other rehabilitation facilities in their area.

Data collection

Once we had a list of the rehabilitation facilities in Victoria, author R.L.S. conducted online searches and telephoned

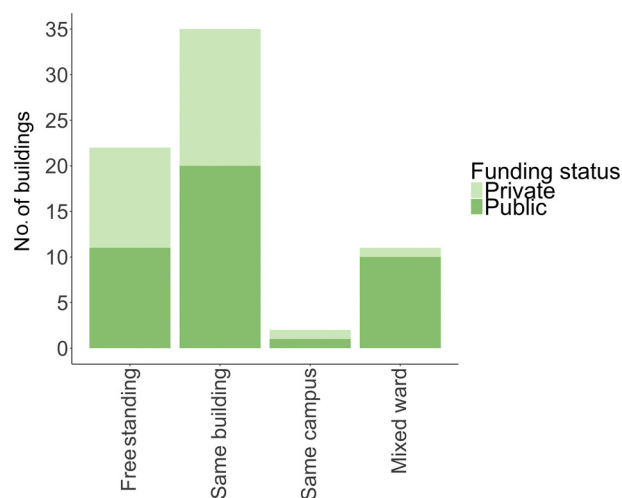


Fig 2 The proximity between buildings that house rehabilitation services and other medical buildings/services. Bars are stacked according to the funding type of the services (public or private). Buildings that housed rehabilitation services were classified as one of the following: freestanding rehabilitation services (ie, not on the same campus as a tertiary hospital), tertiary hospital buildings that included rehabilitation services (ie, in the same building), buildings adjacent to a tertiary hospital building (ie, on the same campus), or buildings that housed rehabilitation beds in a mixed ward.

each facility to collect targeted information about the building (table 1).

Information about new or notable buildings was sometimes included on facility's websites. We also searched Australian health care architecture firms' websites to find rehabilitation facilities in their past projects (Bates Smart, Billard Leece, HSPC Health Architects, Lyons, Silver Thomas Hanley, Team2, Tectura).

To contact each facility, R.L.S. rang the hospital's main switchboard, explained the purpose of the survey, and

asked to be transferred to any staff member (administrative or clinical) in the rehabilitation facility. The respondent was asked to provide the information outlined in table 1. If the initial respondent could not provide the information, R.L.S. asked to be transferred to another staff member who might know more about the building. The final respondent's role at the hospital was noted (ie, receptionist, nurse, etc), but no other identifying information was recorded.

Analysis

All data were analyzed descriptively as counts, percentages, medians, or interquartile ranges (IQRs) using R software.^a All missing data are specified below.

Results

Cross-referencing the AROC members list, the MyHospitals website, and the Victorian Health Services Act revealed 62 rehabilitation facilities. Two further facilities were identified through recommendations by respondents, making a total of 64 inpatient rehabilitation facilities in Victoria, Australia (37 public, 27 private). These 64 facilities are located in 70 buildings (42 public, 28 private) because some facilities are housed across 2 buildings. The deidentified individual facility data, publicly available photographs of the facilities, and an infographic summary of the results are included in supplemental appendixes S1-S3 respectively (available online only at <http://www.archives-pmr.org/>).

The 64 facilities together provide 2524 rehabilitation beds (not including beds that respondents identified as closed because of funding restrictions). The majority of inpatient rehabilitation facility buildings are located in a major city (69%, $n=48$), 27% ($n=19$) are in an inner regional area, and 4% ($n=3$) are in an outer regional area as defined by the Australian Bureau of Statistics (fig 1). The ratio of public to private varied by region:



Fig 3 A rehabilitation facility that is freestanding: St George's Health, St Vincent's Hospital Melbourne, Victoria. Figure 3 (A) (by author R.L.S.) shows the street view, and fig 3 (B) shows an aerial view (from Google Earth). The red arrow indicates the front entrance of the hospital in both images. This building houses a rehabilitation ward, a geriatric evaluation and management ward, outpatient rehabilitation, transitional care units, and a general medical day service, but no emergency or acute services. The scale of fig 3 (B) is the same as the scale of fig 4 (B).

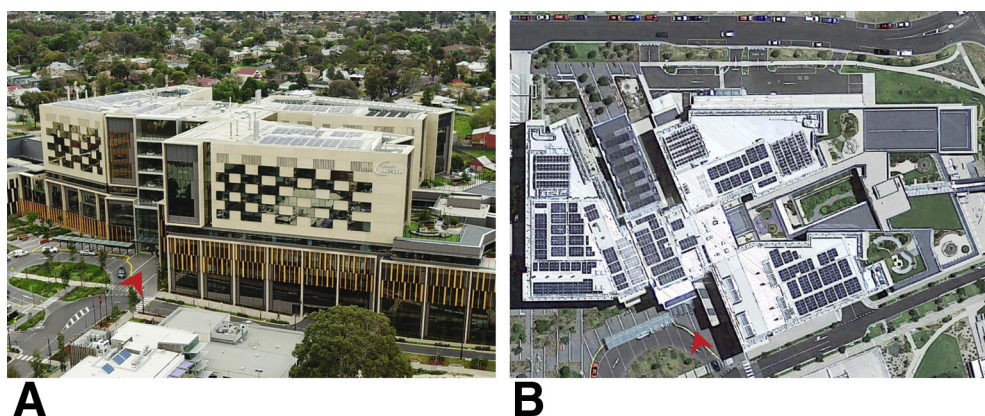


Fig 4 An example of a rehabilitation facility that is in the same building as a large tertiary hospital (ie, not freestanding): Bendigo Hospital, Victoria. **Fig 4 (A)** shows the street view (<https://vhhsba.vic.gov.au/health-infrastructure/bendigo-hospital>), and **fig 4 (B)** shows an aerial view (from Google Earth). The red arrow indicates the front entrance of the hospital in both images. This hospital provides emergency, acute, outpatient, and general medical services to the region. The rehabilitation ward is on the sixth floor. The scale of **fig 4 (B)** is the same as the scale of **fig 3 (B)**.

54% of rehabilitation buildings in a major city are public (n=26), 68% of inner regional buildings are public (n=13), and 100% of outer regional buildings are public (n=3).

Freestanding status

Freestanding status was collected for all 70 of the buildings that house inpatient rehabilitation services (**fig 2**). A total of 31% of these buildings were freestanding rehabilitation facilities, not on the same campus as a tertiary hospital (n=22). Half were tertiary hospital buildings that included rehabilitation services (n=35), 3% were adjacent to a tertiary hospital building (ie, on the same campus but a separate building, n=2), and 16% of the buildings housed rehabilitation beds in a mixed ward (n=11).

Figure 3 shows an example of a freestanding rehabilitation facility and **fig 4** shows a tertiary hospital building that provides many services including inpatient rehabilitation.

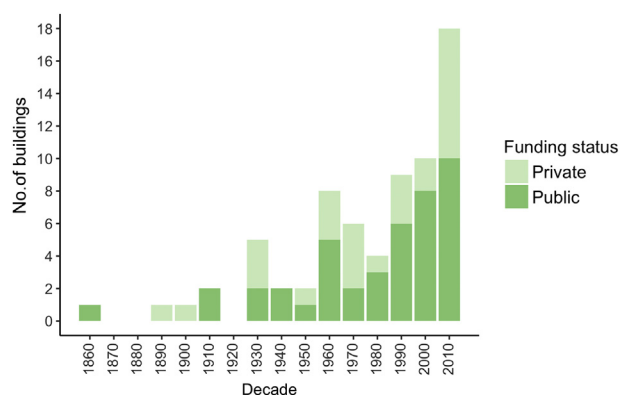


Fig 5 The number of buildings built each decade that currently house public or private inpatient rehabilitation services. Bars are stacked according to the funding type of the services (public or private).

Size of facility

The number of buildings, wards, and beds allocated to rehabilitation services was collected for all 64 facilities (see [supplemental appendix S1](#), available online only at <http://www.archives-pmr.org/>). The number of beds allocated to rehabilitation at each facility varied between 2 and 104. The median number of rehabilitation beds per ward was 26 (IQR, 20-30; range, 2-42) and 30 (IQR, 21.1-30.6; range, 6-46) for public and private facilities, respectively.

Most of the 11 mixed wards held a combination of rehabilitation and geriatric evaluation and management beds (46%, n=5 wards). The other mixed wards combined rehabilitation beds with general medical and acute (27%, n=3 wards), palliative (8%, n=1 ward), alcohol and other drug (8%, n=1 ward), and sleep assessment (8%, n=1 ward). On average, 54% of the beds on these wards were dedicated to rehabilitation (range, 14%-88%).

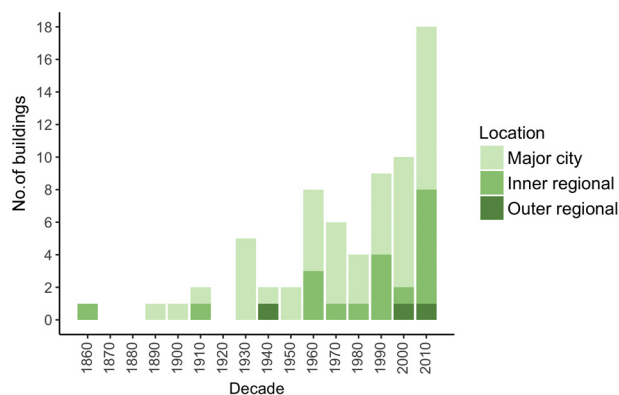


Fig 6 The number and location of buildings built each decade that currently house inpatient rehabilitation services. Bars are stacked according to the location of the services (major city, inner regional, outer regional).

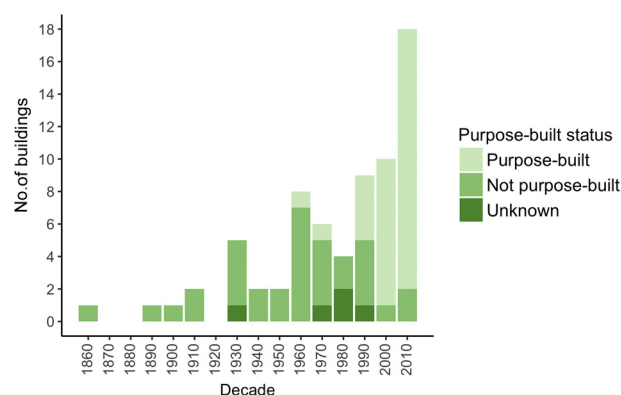


Fig 7 The number of buildings built each decade that currently house inpatient rehabilitation services. Bars are stacked according to whether or not the buildings were purpose-built for rehabilitation.

Age of building

The building's age was obtained for 69 of the 70 buildings. The number of rehabilitation buildings being built has increased over time, with 26% of the buildings having been built since 2010 ($n=18$), including 6 between 2016-2017. The oldest rehabilitation facility building in Victoria was originally built in 1860 as a psychiatric facility. Figures 5-8 show the number of buildings built each decade that now house rehabilitation services, whether they are public or private, their location (major city, inner regional, outer regional), whether they were originally purpose-built for rehabilitation, and their freestanding status.

For 68 of the 70 buildings, we could determine whether or not the building had been renovated since being built (97%). Of these 68 buildings, 60% had been renovated at least once ($n=41$). Of the 49 buildings built before 2010, 80% had been renovated at least once ($n=39$). Of the 39 buildings built before 2000, 92% had been renovated at least once ($n=36$). The extent of the renovations varied widely, with some buildings having only bathroom remodeling or new flooring, while other renovations involved a complete overhaul of the ward or gym. In their comments, some staff mentioned a need for renovation of outdated facilities, especially a need for more storage space. However, other staff mentioned that a renovation would be of no use; the building would need to be remade from scratch to suit their needs. The barriers to renovation were largely financial but not exclusively. For example, 4 of the private facilities are located in buildings that were once notable private houses, some of which are heritage listed.

Purpose-built status

We defined buildings as purpose-built if they were originally designed and built specifically to house rehabilitation services. Purpose-built is therefore defined by design intent, and the purpose-built buildings in our sample may be heterogeneous in their designs and features. We were able to determine whether the building had been purpose-built for rehabilitation for 65 of the 70 buildings (93%). Half of these

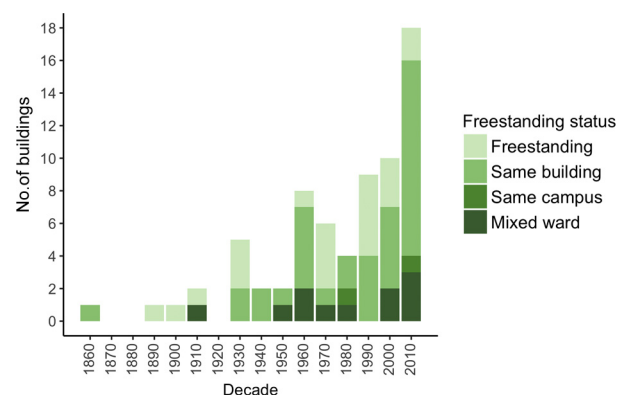


Fig 8 The number of buildings built each decade that currently house inpatient rehabilitation services. The bars are stacked according to the proximity of these buildings to other medical buildings/services. Buildings that housed rehabilitation services were classified as one of the following: freestanding rehabilitation facilities (ie, not on the same campus as a tertiary hospital), tertiary hospital buildings that included rehabilitation services (ie, in the same building), buildings adjacent to a tertiary hospital building (ie, on the same campus), or buildings that housed rehabilitation beds in a mixed ward.

65 buildings had not been purpose-built for rehabilitation (52%, $n=34$). Figure 9 shows that a higher proportion of private facilities were not purpose-built (61%, $n=17$) compared with public (46%, $n=17$). The majority of the rehabilitation facilities built since 2010 were purpose-built (89%, $n=16$) (see fig 7). The 2 built since 2010 that were not purpose-built were both designed to be identical to the general medical wards in the same building.

The original purpose of the 34 nonpurpose-built buildings was acute medical (50%, $n=17$), maternity (15%, $n=5$), aged care (12%, $n=4$), private residence or stately home (12%, $n=4$), psychiatric or mental health (6%, $n=2$), and a trade union training college (3%, $n=1$). The original purpose of 1 building could not be determined (3%).

Layout of building

The layout of the buildings varied widely. Some wards followed a standard single corridor design, others followed a U-shaped corridor design, others followed a triangle or race-track design, and some had entirely unique layouts, for example, those that were previously private residences. The percentage of single-bed rooms was collected for 68 of the 70 buildings (97%). In these 68 buildings, the median percentage of rehabilitation beds located in a single-bed room is 55% (IQR, 29%-80%). The median percentage was higher in purpose-built buildings (74%; IQR, 33%-97%) and in buildings built since 2010 (77%; IQR, 73%-100%). Figure 10 shows the proportion of single-bed rooms in public and private facilities that were purpose-built and those that were not.

A therapy gym was accessible in all facilities. The location of the gym in relation to the ward was reported for all buildings. A total of 44% ($n=31$) of the buildings had a gym colocated on the rehabilitation ward, although some of

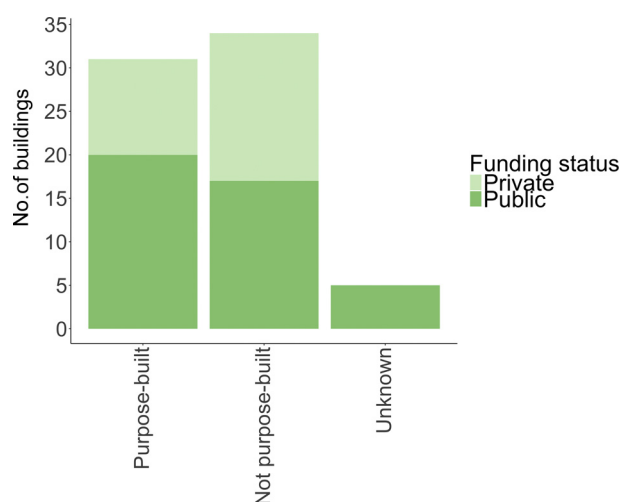


Fig 9 The purpose-built status of buildings that house rehabilitation services. Bars are stacked by the funding type of the services (public or private).

these had other therapy services located off ward (such as hydrotherapy, occupational therapy kitchen, additional larger gym). In 56% of the buildings, the gym was located on a separate floor to the rehabilitation ward, a separate section of the building, or in a separate building altogether ($n=39$); this was also the case for 42% of the purpose-built facilities ($n=13$).

Information regarding indoor communal spaces was collected for all buildings, and information regarding outdoor communal spaces was collected for 99% of the buildings ($n=69$). A total of 96% of the buildings had either an indoor or outdoor communal space for patients on all rehabilitation wards ($n=67$). Most of the buildings had an indoor communal space, such as a lounge or dining room (93%, $n=65$). Of the 5 buildings that did not have an indoor communal space, 4 were private, 1 was public, 1 was purpose-built for rehabilitation, and all were built prior to

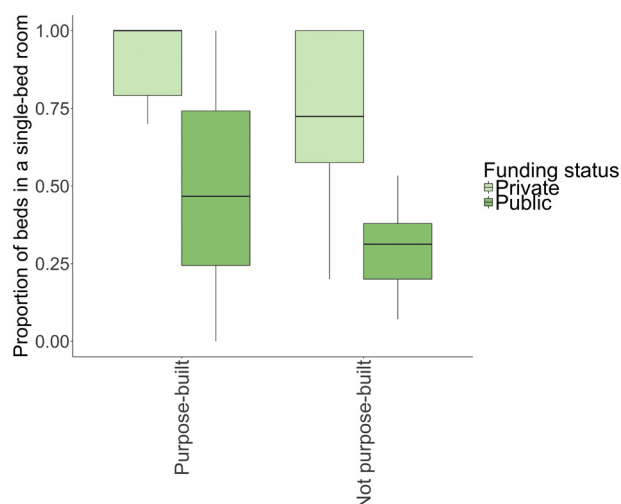


Fig 10 The proportion of public and private rehabilitation beds that are located in a single-bed room in buildings that were purpose-built and those that were not purpose-built.

2010. A total of 61% of the buildings had an outdoor communal space, such as a courtyard, garden, or balcony ($n=42$), and a further 5 buildings had an outdoor communal space available on some but not all rehabilitation wards (7%). About half of the buildings that had no outdoor communal space on any of the rehabilitation wards were public (59%, $n=13$); most were built prior to 2010 (73%, $n=16$) and were not purpose-built (64%, $n=14$). Some respondents noted that their indoor or outdoor communal spaces were rarely or never used by patients.

Discussion

This study provides the first description of inpatient rehabilitation facility buildings in Australia.

Implications

The survey revealed notable heterogeneity in the rehabilitation facility buildings on most of the variables measured, including size, age, purpose-built status, freestanding status, proportion of single-bed rooms, and layout. The only consistency was that most facilities have a communal area and all have a therapy gym, which is in line with current Australian Healthcare Design Guidelines.¹² The variation in the location of the gym in relation to the ward suggests that it may be more accessible in some buildings than others, which could affect patients' activity levels.¹⁶

It may be that the heterogeneity in rehabilitation facility design reflects the heterogeneity of rehabilitation patients' needs and capacities. However, many rehabilitation facilities are not specialized and so must accommodate all patients.¹⁷ Patient outcomes vary between rehabilitation facilities,¹⁷ and there is growing recognition of the interaction between the health care environment and clinical outcomes.^{1,18} It would be timely to investigate whether there are relationships between the variations in rehabilitation facility design and patient outcomes.

The average numbers of beds per building and per ward were similar for public and private rehabilitation facilities. However, the proportion of publicly funded rehabilitation facilities compared with private is higher in rural areas, with all outer regional rehabilitation facilities being publicly funded. A higher proportion of publicly funded rehabilitation facilities are purpose-built compared with private facilities, and privately funded buildings are more likely to be freestanding. It is not uncommon for patients in rehabilitation to require transfer to an acute facility for short-term care for an acute-onset illness, and earlier transfers are associated with lower mortality.¹⁹ Proximity of rehabilitation and acute facilities may be an important design consideration for rehabilitation.

Our survey showed that many new rehabilitation facilities have been built in the last 10 years and that most older buildings have been renovated. New health care facilities and renovations require significant financial investment. Acute health care building designs that follow the latest evidence-based design research have been shown to improve clinical outcomes and provide return on investment.^{18,20,21} Half of the rehabilitation facilities in our

survey were not purpose-built for rehabilitation and were refurbished as clinical demands changed over time. Evidentially, as well as being purpose-built for their intended purpose, health care buildings should also be designed to be adaptable should their purpose change.

Design intent was central to our definition of what constitutes purpose-built, but rehabilitation facilities are currently being built and refurbished with little to no rehabilitation-specific evidence base behind the design. This raises the question of what purpose-built really means in the context of contemporary rehabilitation facility design. How are the designs of purpose-built rehabilitation facilities different from rehabilitation facilities that were not purpose-built? And what informed these design choices? Future research could address these questions by analyzing the design briefs of purpose-built and nonpurpose-built facilities or by interviewing architects and hospital planners to understand the rationales behind their choices.²² A detailed survey of renovations in nonpurpose-built facilities, including any planned renovations, would indicate the relative priority of different design features.

The results of this survey suggest that there is a high proportion of single-bed rooms in rehabilitation buildings, particularly in private facilities and especially in those that were recently built or purpose-built. There is evidence that single-bed rooms are beneficial for infection control, clinician/patient communication, patient perception of care, and sleep quality in acute medical settings.³ However, clinical priorities in rehabilitation may be different from priorities in an acute medical environment. Multibed rooms may be better at meeting some of these priorities, such as reducing falls risk²³ and promoting social connection.²⁴ The growing proportion of single-bed rooms suggests that rehabilitation facility design is influenced by evidence from acute medical settings and current design trends.

Study limitations

We acknowledge that this study considered only the rehabilitation facilities in Victoria, Australia. While Victoria is the second most populous state in Australia, it has fewer remote regions than the rest of the country, and the results of this study may not be generalizable to the whole of Australia. There would be value in interrogating all the rehabilitation facilities in Australia to compare differences between states and regions.

The data collection method used in this study produced an excellent response rate but may have had drawbacks in terms of the reliability of the data because the role and expertise of the respondent varied between facilities. Some respondents were incredibly knowledgeable about the building and generously provided additional information, such as leaflets about the history of the building, while other respondents were less confident in their responses. This led to missing data for some variables where information could not be obtained through publicly available websites. Individual site visits could produce more detailed and complete data. Future surveys could be supported by standardized collection of data about important

design features; however, no rehabilitation-specific built environment audit tool currently exists.

This study highlights current gaps in knowledge about rehabilitation facility design. Although we selected variables that we believed important to survey, the relative importance of these or other built environment features on patient outcomes and staff outcomes is unknown. Research completed after this survey was conducted has begun to address this issue.²⁵ Future built environment surveys could link to clinical registry data to investigate whether the presence of particular design features affects patient outcomes. Understanding how patients and staff behave within a rehabilitation environment in response to building features would also be valuable. Here, qualitative data collection and analysis methodologies or spatial analysis tools, such as space syntax, may be the best research option.²⁶ Future research would benefit from considering the perspectives of the users of the facilities—patients, staff, and visitors. Ready access to floor plans and design briefs would also help facilitate research. This is not currently the norm in Australia.

Conclusions

Without research into rehabilitation facility buildings, it is difficult for health care planners and architects to produce evidence-based designs. This study represents the first step in a series of projects to investigate rehabilitation environments and suggests critical questions for a wider survey of rehabilitation buildings that could be linked to patient outcomes data. We need to understand the current state of these buildings before we can optimize them for rehabilitation.

Supplier

a. R software; R Foundation for Statistical Computing.

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2.4 Chapter summary and conclusions

The variability in physical environments observed in this survey speaks to the complexity of the topic and the many external factors that may influence patients' behaviour and emotional well-being. While all facilities had a therapy gym, and the vast majority a communal area, the accessibility of the gym from the ward varied and comments from respondents indicated that the communal areas were often not used by patients. It is important to consider what aspects of the environment might impact the accessibility and useability of key spaces.

This survey raised questions about the concept of purpose-built buildings, and how evidence is translated by architects and designers. Most of the rehabilitation facilities in this survey were not purpose-built, but even those that were may not have had the appropriate evidence-based foundation to be fit for purpose. The growing proportion of single-bed rooms in rehabilitation facilities, for example, suggests that rehabilitation facility design is influenced by evidence from acute medical settings and current design trends, rather than reflecting the unique purpose of rehabilitation. Indeed, this may be a worldwide trend; a study in Sweden found that stroke patients in rehabilitation hospitals were not more physically active than patients in acute hospitals and concluded that the inpatient rehabilitation environment does not promote physical activity any more than the acute environment (Åstrand et al., 2016). If the purpose of rehabilitation is learning and recovery (as defined in Section 1.1.2), and patients need to have beneficial behaviours and emotional well-being in order to facilitate this learning and recovery, then what must the physical environment provide in order for inpatient rehabilitation facility buildings to be fit for purpose? In response to this question, Study 2 sought to define what is important in the physical environment of inpatient rehabilitation facilities for learning after stroke.

3 Study 2: Expert elicitation workshops

3.1 Chapter overview

This chapter contains Study 2 of this thesis. This study was an interdisciplinary expert elicitation study, which addressed the question of what is important in the physical environment of inpatient rehabilitation facilities for the post-stroke learning process (addressing the primary aim of this thesis, see Section 1.6). The expert elicitation was carried out over two workshops using Value-Focused Thinking (Keeney, 1992). The first section of this chapter provides a rationale for Study 2. Section 3.3 contains the published manuscript of this study and Section 3.4 describes some further results that were not included in the published manuscript.

Ethics approval for this study is included in Appendix 4. The workshop pre-reading document and workshop summary documents are in Appendix 5. The glossary that is mentioned in the method section of the manuscript is included in the workshop 1 pre-reading document. Additions to the glossary made throughout the workshops are in the workshop 2 summary document. The supplementary material for the manuscript can be found in Appendix 6.

3.2 Study rationale

Rehabilitation is a learning and re-learning process, but, as discovered in Study 1, rehabilitation facilities are often not purpose-built or designed to support this process. The aim of Study 2 was to understand what is important in the physical environment of inpatient rehabilitation facilities for learning after stroke.

According to Behaviour Setting theory, if the physical and social environments of a rehabilitation facility are fit for purpose, then they should generate a behaviour setting that encourages behaviours and a level of patient engagement that is beneficial for learning (practice, activity, and rest) (see Section 1.3.1). We know from past research that these beneficial behaviours are often not observed in rehabilitation (see Section 1.2.3). This raised the question of whether there are other types of behaviour settings that do encourage these beneficial behaviours? This question, generated from Behaviour Setting theory, informed the design and interdisciplinary nature of Study 2 (as indicated in Section 1.5.3).

Education spaces such as schools, universities, museums, and libraries are designed to facilitate learning. Like healthcare environments, learning environments are complex systems with interactions between human behaviour, the social environment (other people in the space, pedagogical models, etc.), and the physical environment. Students may have competing needs, and there are many outcomes and curricula that must be met at the level of the student, teacher, education facility, and governing bodies. In general, there has been a transition in the last thirty years towards less didactic and more student-directed learning (Boys, 2010), which is analogous to the shift in healthcare towards patient-centred care. The design of schools and universities has changed in response to this new pedagogy, from traditional lecture theatre or classroom-based learning to more innovative and diverse learning spaces (Newton & Fisher, 2009; OECD, 2013), and these changes have been linked to changed learning outcomes (Barrett, Davies, Zhang, & Barrett, 2015, 2017). These innovative learning spaces are designed to encourage engagement, motivation, and emotional well-being (OECD, 2011) – internal states which are similarly important for patients in rehabilitation (see Section 1.2.2).

In recent decades, there have been significant advancements in clinical understanding of the rehabilitation process (e.g., neuroplasticity [Draganski et al., 2004]) and promotion of changes in clinical approach (e.g., patient-centred care [Leplege et al., 2007]), but there has been very little innovation in rehabilitation facility design in response to these developments. Healthcare environments are yet to undergo the design innovations experienced in learning environments. When designing Study 2, I took the novel position that rehabilitation facilities could be conceptualised as both a learning space and a healthcare space. Perhaps innovations in learning environments design could be translated into a rehabilitation environments context and so change these behaviour settings for the better?

The conceptualisation of rehabilitation facilities as both a learning space and a healthcare space informed the interdisciplinary nature of Study 2, namely, the types of experts who were invited to participate in the expert elicitation process. All of the invited experts had the knowledge to inform the design of inpatient rehabilitation environments and optimise them for learning after stroke. The invited experts included policy makers, researchers and academics in learning and healthcare, architects and designers of learning and healthcare environments, and people who use rehabilitation facilities (staff, patients, visitors).

3.3 Publication

Lipson-Smith, R., Churilov, L., Newton, C., Zeeman, H., & Bernhardt, J. (2019). A Framework for Designing Inpatient Stroke Rehabilitation Facilities: A New Approach Using Interdisciplinary Value-Focused Thinking. *HERD: Health Environments Research & Design Journal*, 12(4), 142-158.

A Framework for Designing Inpatient Stroke Rehabilitation Facilities: A New Approach Using Interdisciplinary Value-Focused Thinking

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Abstract

Aim: To use Value-Focused Thinking to investigate what is important in the design of inpatient stroke rehabilitation facility buildings. **Background:** Many stroke patients require inpatient rehabilitation in a dedicated facility. Rehabilitation facilities are healthcare spaces, but they are also learning spaces where patients practice targeted tasks to acquire new skills and to reacquire skills and abilities that were compromised as a result of their stroke. There is currently no consensus regarding how the design of inpatient rehabilitation facilities could be optimized for patients' learning. **Method:** We used Value-Focused Thinking to develop a framework of what interdisciplinary experts consider important for inpatient stroke rehabilitation facility design. Two workshops were conducted. The following experts were invited to participate: past patients with experience of stroke rehabilitation; stroke rehabilitation clinicians; stroke rehabilitation academics; healthcare environments academics; learning environments academics; architects, designers, and wayfinders with experience designing healthcare or learning environments; and healthcare design policy makers. **Results:** Thirty experts participated. The experts' final framework included 16 criteria that were considered fundamentally important for inpatient stroke rehabilitation facility design, and 14 criteria that were considered instrumentally important. Inpatient stroke rehabilitation facility design should maximize efficiency, maximize effectiveness (i.e.,

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patients' clinical and functional outcomes), foster emotional well-being, and maximize safety. Opportunities to practice physical, cognitive, and social activity were considered important for patients' outcomes. **Conclusions:** Value-Focused Thinking was an effective and equitable means of engaging experts from multiple disciplines. Designers, planners, and developers of inpatient stroke rehabilitation facilities should consider the rehabilitation-specific framework developed in this study alongside evidence from other healthcare settings.

Keywords

stroke, rehabilitation, built environment, hospital design, learning environments design, Value-Focused Thinking, interdisciplinary

Each year, over 50 million people worldwide have a stroke (Thrift et al., 2017). After receiving acute care in hospital, 75% of stroke survivors have ongoing rehabilitation needs, which are often provided in a dedicated inpatient rehabilitation facility (Stroke Foundation, 2017). The aim of this study was to describe what should be prioritized in the design of inpatient stroke rehabilitation facilities.

The aim of this study was to describe what should be prioritized in the design of inpatient stroke rehabilitation facilities.

Rehabilitation is defined as “a process of active change by which a person who has become disabled acquires the knowledge and skills needed for optimal physical, psychological and social function” (British Society of Rehabilitation Medicine, 2003, p. 7). This definition emphasizes that rehabilitation is a learning process. The impact of stroke can be wide-ranging, and no two strokes are the same; commonly, patients in stroke rehabilitation may need to relearn motor skills (e.g., walking and/or arm-use) and/or cognitive abilities (e.g., speaking or understanding speech, planning and execution of everyday tasks). In addition, they may need to learn entirely new skills in response to their changed condition (e.g., learning to use a walking frame). Clinical guidelines for stroke rehabilitation recommend cognitive stimulation, physical exercise, and repetitive goal-directed practice to promote optimal relearning (Stroke Foundation, 2017; Weinstein et al., 2016). Unfortunately, stroke patients in inpatient rehabilitation facilities are largely

inactive and alone (West & Bernhardt, 2012) and frequently bored (Kenah et al., 2017). When designing this study, we took the novel position that stroke rehabilitation facilities could be reconceptualized as *learning environments* as well as healthcare environments where patients are enabled to engage in and practice the necessary physical, social, and cognitive functions to achieve optimal recovery after stroke.

... we took the novel position that stroke rehabilitation facilities could be reconceptualized as learning environments as well as healthcare environments.

Most healthcare design research is conducted in acute settings (Ulrich et al., 2008). General hospital design guidelines and regulations should inform rehabilitation facility design, but rehabilitation-specific recommendations are also needed. Only a handful of empirical studies have considered the built environment of inpatient stroke rehabilitation facilities (Anåker, von Koch, Sjöstrand, Bernhardt, & Elf, 2017; Blennerhassett, Borschmann, Lipson-Smith, & Bernhardt, 2018; Janssen et al., 2014; Katrak et al., 2011; Khan et al., 2016; Mackey, Ada, Heard, & Adams, 1996), so the unique requirements of these environments for people who have had a stroke are not well documented or understood.

Many stakeholder perspectives must be considered if we are to develop a shared understanding of how stroke rehabilitation facility design could be optimized for learning. We followed the definition of interdisciplinarity adopted by Choi

and Pak (2006)—to “analyze, synthesize and harmonize links between disciplines into a coordinated and coherent whole” (p. 354)—and aimed to synthesize the perspectives of stroke patients, clinicians, policy makers, architects and designers, health environments researchers, and learning environments researchers. Importantly, we involved learning environments experts in this research to help to reconceptualize rehabilitation spaces as learning spaces. The design of schools and universities is shifting from classroom-based learning to innovative spaces that encourage collaboration and social participation and consider issues of health, comfort, safety, and stimulation (Organisation for Economic Cooperation and Development, 2011). The original contributions of this study were to (1) develop a framework of what experts think is important in the design of inpatient stroke rehabilitation facilities, (2) reconceptualize rehabilitation facilities as learning environments, and (3) apply Value-Focused Thinking to facilitate systematic, interdisciplinary design research.

Many stakeholder perspectives must be considered . . .

. . . apply Value-Focused Thinking to facilitate systematic, interdisciplinary design research

The Value-Focused Thinking Approach to Decision-Making

Value-Focused Thinking is an approach for making better decisions (Keeney, 1992). It encourages decision makers to consider *what* they want (i.e., what they value) *before* considering how they can *get* what they want (i.e., the possible alternatives; Keeney, 1992). “Values” are defined as the things decision makers think are important in a particular decision-making context (Keeney, 1992). The decision-making context for this study was: *What is the optimal design of inpatient stroke rehabilitation facilities?* A person taking an alternative-focused approach to this decision would compare different existing rehabilitation facility designs and

decide which one is best. A person taking a Value-Focused Thinking approach would first define what is important, or of value, in the built environment of rehabilitation facilities *before* comparing alternative designs.

Value-Focused Thinking requires users to articulate their values as “objectives,” where an objective is a statement of what would ideally be achieved in the decision-making context (Keeney, 1992). Keeney (1992) described a distinction between *fundamental objectives* and *means objectives*. Fundamental objectives are fundamentally important in and of themselves. Means objectives are instrumentally important because they help to achieve one or more of the fundamental objectives. Fundamental objectives are organized into a hierarchy, and means objectives are organized into a network that feeds into the hierarchy of fundamental objectives.

Method

Value-Focused Thinking was used to identify what interdisciplinary experts consider important in the design of inpatient stroke rehabilitation facilities. The Value-Focused Thinking process was conducted over two workshops in late 2017. This project received ethical approval from the University of Melbourne, Australia (ID: 1648218.1).

Workshop Participants

The workshop participants were selected using impressionistic modal instance sampling (Sal- kind, 2010). Target disciplines were chosen, and experts in these disciplines were invited to participate, so that all of the predetermined disciplines were represented in the final sample. The target disciplines were patient consumers with lived experience of stroke rehabilitation; stroke rehabilitation clinicians; stroke rehabilitation academics; healthcare environments academics; learning environments academics; architects, designers, and wayfinders with experience of designing healthcare environments or learning environments; and healthcare design policy makers (see Table 1). Experts were identified through existing collaborative networks known to the

Table 1. The Expert Disciplines That Were Targeted for Participation in the Workshops.

Discipline	Healthcare Environments	Learning Environments	Stroke Rehabilitation
Academic (researcher)	✓	✓	✓
Design (architect or wayfinder)	✓	✓	N/A
Clinical (clinician or past patient)	N/A	N/A	✓
Policy	✓	N/A	N/A

	Fundamental objectives	Means objectives
To move:	Downward in the hierarchy:	Away from fundamental objectives:
Ask:	<i>“What do you mean by that?”</i>	<i>“How could you achieve this?”</i>
To move:	Upward in the hierarchy:	Towards fundamental objectives:
Ask:	<i>“Of what more general objective is this an aspect?”</i>	<i>“Why is this important?”</i>

Figure 1. Four questions to structure the Value-Focused Thinking process. This figure shows the four questions that were used in the workshops and during analysis to identify the fundamental objectives and to organize them into a hierarchy. This figure is adapted from Clemen and Rielly (2014).

researchers. Preference was given to people with expertise in two or more of the target disciplines. All participants completed a consent form and a questionnaire about the nature and extent of their expertise.

Workshop Format

The workshops ran for 4.5 hr each and were facilitated by authors Lipson-Smith (student researcher) and Churilov (Value-Focused Thinking expert). Prior to Workshop 1, participants were given a prereading document with background on stroke rehabilitation and Value-Focused Thinking, links to key references, and a glossary of jargon specific to the participants' various disciplines. Glossaries are needed in interdisciplinary research to recognize and explain discipline-specific language and ways of knowing (Newton & Fisher, 2009). The glossary was added to throughout the workshops, and participants were encouraged not to use acronyms or

jargon. The workshops were audio-recorded to assist with analysis.

Workshop 1. The priority for Workshop 1 was to develop a hierarchy of fundamental objectives. Participants were divided into four interdisciplinary workgroups and were asked to brainstorm what they value as important in the design of inpatient stroke rehabilitation facility buildings. Participants were encouraged to focus on *concepts* rather than be constrained by specific design solutions or features. Each workgroup articulated their values as objectives and then interrogated each objective using the four questions in Figure 1 (Clemen & Reilly, 2014). These questions were thus used to identify the fundamental objectives and to organize them into a hierarchy. The participants' goal was to define a set of fundamental objectives that were mutually exclusive of each other (i.e., no overlap in meaning or content between the objectives) and collectively exhaustive (i.e., the final set of objectives should together cover everything that is

Table 2. The Number of Participants Representing Each Target Discipline.

Discipline	Healthcare Environments	Learning Environments	Stroke Rehabilitation	Total
Academic (researcher)	4	6	5	15
Design (architect or wayfinder)	5	2	N/A	7
Clinical (clinician or past patient)	N/A	N/A	6	6
Policy	2	N/A	N/A	2
Total	11	8	11	30

Note. Participants are listed according to their primary expertise only.

fundamentally important in the design of inpatient stroke rehabilitation buildings). Each workgroup's hierarchy was refined iteratively throughout the workshop in response to feedback from other participants. After Workshop 1, the four workgroups' hierarchies were combined into one synthesized hierarchy by Lipson-Smith (see Analysis section) and circulated to all participants. Participants were encouraged to review the hierarchy before Workshop 2 and provide feedback. Experts who participated in Workshop 2 but not Workshop 1 were given a summary prior to Workshop 2.

Workshop 2. A final version of the synthesized hierarchy of fundamental objectives was presented, and the participants discussed the means objectives that may be important in achieving each of the fundamental objectives. For each means objective, the participants identified which other objective/s it may impact and thereby developed a draft network. The draft network was refined after Workshop 2 (see Analysis section) and circulated to all participants.

Analysis

Synthesizing the hierarchy of fundamental objectives. To synthesize the four workgroups' hierarchies, Lipson-Smith studied the written output and audio recordings from Workshop 1. Identical or similar fundamental objectives were combined, and the questions in Figure 1 were used to confirm the position of each objective in the hierarchy or to relegate it to the network of means objectives. All of the fundamental objectives identified in Workshop 1 were represented within

the final, synthesized hierarchy. The workshop audio recordings were used to create detailed definitions for each of the fundamental objectives. The hierarchy was reviewed by authors Churilov and Bernhardt before being sent to participants for feedback. Disagreements were discussed until consensus was reached.

Refining the network of means objectives. Lipson-Smith referred to written output and audio recordings from Workshop 2 to refine the network of means objectives. Identical or similar means objectives were combined, and objectives that were considered subsidiary were incorporated into the definition of another objective or represented by connections between objectives. Everything that was discussed in the workshops was thereby included in the final network. The hierarchy, network, and accompanying definitions together constitute the framework of what is important for inpatient stroke rehabilitation facility design. The framework was reviewed by Churilov and Bernhardt before being sent to participants for feedback. Disagreements were discussed until consensus was reached.

Results

Workshop Participants

Thirty-seven experts were invited to attend the workshops. One expert in a policy/government role did not respond when approached. Six experts declined due to scheduling conflicts (two architects, two clinician/researchers, one architect/researcher, and one architect with a clinical background). People with similar expertise were then approached to replace them. Thirty experts

Table 3. The Type and Extent of the Workshop Participants' Expertise.

Expertise	Workshop 1 (n = 26)		Workshop 2 (n = 14)	
	No. of Participants With This Expertise, n ^a	No. of Years of Experience or Since Stroke, Median (Range)	No. of Participants With This Expertise, n ^a	No. of Years of Experience or Since Stroke, Median (Range)
Academic				
Architecture (general)	6	11.5 (1–20)	2	18.5 (17–20)
Stroke rehabilitation	3	15 (1–17)	3	15 (1–17)
Environmental psychology	1	15	0	0
Health environments	6	5.5 (2–40)	2	5.5 (5–6)
Learning environments	6	7 (1–15)	2	6.5 (3–10)
Clinical				
Horticultural therapist	1	15	0	0
Neuropsychology	1	15	1	15
Nurse	4	19.5 (8–25)	2	21.5 (8–35)
Patient consumer	2	5.5 (4–7)	2	5.5 (4–7)
Physiotherapist	2	20 (20–20)	1	20
Rehabilitation physician	1	20	1	20
Design				
Architecture (general)	6	21 (12–35)	2	10 (3–17)
Architecture (health)	3	22 (20–40)	1	20
Architecture (learning)	2	22.5 (15–30)	1	15
Wayfinding	2	23.5 (22–25)	2	25 (25–25)
Policy				
Clinical planning	1	25	0	0
Government	1	2	0	0

^aThe total n of participants by expertise does not equal the n in the workshops because 14 of the participants had two or more areas of expertise (see Table 4).

consented to participate, and all attended at least one workshop. Table 2 shows the primary expertise of the participants, and Table 3 details the nature and extent of their expertise.

Three of the participants are authors of this manuscript (Bernhardt, Newton, and Zeeman), and the remaining participants are thanked in the Acknowledgments section with their permission. Of the 30 experts, 16 attended Workshop 1 only, 4 attended Workshop 2 only, and 10 attended both. Although some of the participants had previously worked internationally, they all lived and worked in Australia at the time of participation. Most were residents of the state of Victoria, one from Western Australia, one from South Australia, and one from Queensland. Fourteen of the experts had dual expertise or previous careers relevant to the project (see Table 4).

Table 4. The Workshop Participants' Dual or Previous Expertise.

Type of Dual or Previous Expertise	No. of Participants, n
Academic + clinical	4
Academic + design	7
Academic + design + clinical	1
Policy + clinical	1
Policy + design	1
Total	14

A Framework of What Is Important in the Design of Inpatient Stroke Rehabilitation Facility Buildings

Figure 2 shows the hierarchy of fundamental objectives that participants identified as important in the design of inpatient stroke rehabilitation

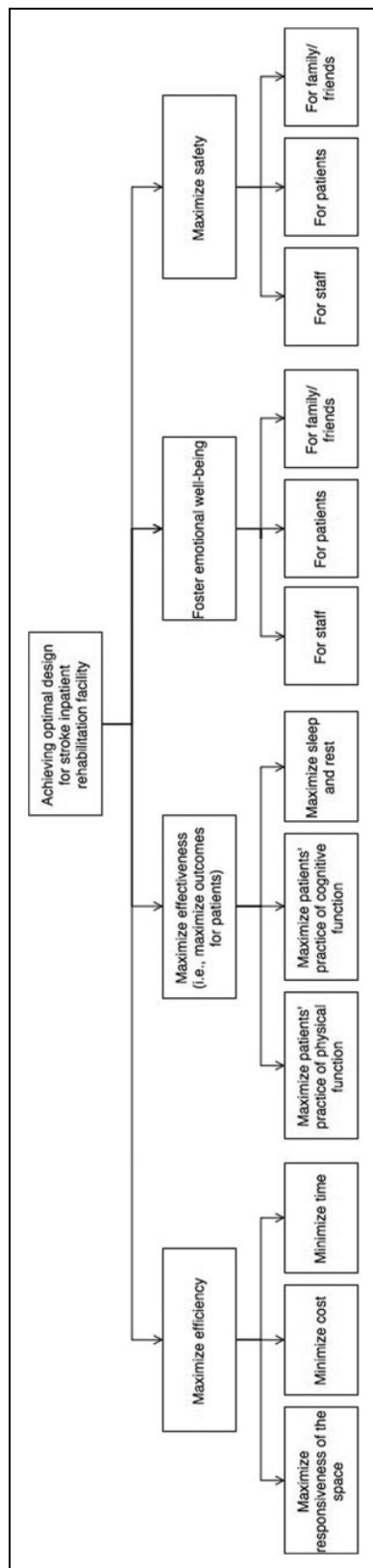


Figure 2. The hierarchy of fundamental objectives from the framework of what is important in the design of inpatient stroke rehabilitation facility buildings. This figure shows the connections between the 4 first-tier fundamental objectives and the 12 second-tier fundamental objectives that were identified in the workshops.

buildings and interiors. The four top-level fundamental objectives state that an optimal design for these buildings should *maximize efficiency*, *maximize effectiveness*, *foster emotional well-being*, and *maximize safety*. The fundamental objectives are defined below with illustrative quotes from participants.

Fourteen means objectives were identified. Some criteria that were originally suggested as fundamental objectives were later reconsidered as means objectives instead. For example, *maximize the legibility of the space* was originally considered a fundamental objective but was then relabeled as a means objective because the legibility of the space was considered important due to its role in achieving the fundamental objectives in the hierarchy, not because it was fundamentally important in and of itself. The means objectives are listed in Table 5 and described in detail in the Supplementary Material. Some examples of the means objectives are included in-text below to demonstrate how they relate to the fundamental objectives in the hierarchy.

Maximize efficiency. The workshop participants decided that it is important that inpatient stroke rehabilitation facilities *maximize efficiency* of care delivery (see Figure 2). A rehabilitation physician noted that “Efficiency drives everything for us . . . the value is around managing the resources that you have in order to get extra things” The concept of efficiency incorporates objectives relating to *cost*, *time*, and the *responsiveness of the space*.

“Efficiency drives everything for us . . .

The objective to *minimize cost* refers to costs incurred over the lifetime of the building. This objective emphasizes sustainability and recognizes direct and indirect costs related to design. Direct costs may be up front (e.g., land purchase) or ongoing (e.g., building repairs). Examples of indirect costs may include salary cost of staff giving directions to lost patients or visitors, or recruitment costs due to staff turnover. The optimal design of a rehabilitation facility should also *minimize time* for all

Table 5. The 14 Means Objectives Identified by the Workshop Attendees.

Means Objective	Description	Is a Means to Achieving the Following Objectives
Maximize the adaptability of the space	Ability to change over the long term and midterm (i.e., years or months) in response to new knowledge, requirements in clinical practice, or unprecedented new technologies.	• Maximize the responsiveness of space • Minimize cost • Incorporate and support adequate technology
Maximize the versatility of the space	Ability to change over the short term (i.e., hours or days) in response to different clinical programs or immediate needs of people. Some spaces should be agnostic and customizable, and more prescriptive spaces should still allow some personal control over the space. A versatile space can be altered as patients' needs, sensitivities, and preferences change, so that it both promotes practice and is conducive to rest.	• Maximize the responsiveness of space • Minimize cost • Minimize time • Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Maximize opportunities for effective sleep and rest • Maximize safety for staff • Maximize safety for patients • Maximize safety for family/friends • Maximize personal control over the space
Incorporate and support adequate technology	Support the necessary technologies for administration and clinical practice. The design should be able to adapt as these technologies evolve. Technology can save time for staff, reduce costs, and make the space more responsive. Technology can promote practice (e.g., robotics, interactive computer games, VR), promote effective rest (e.g., lighting for circadian rhythms), maximize safety (e.g., duress systems, floor sensors, smoke alarms), and facilitate wayfinding.	• Maximize the responsiveness of space • Minimize cost • Minimize time • Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Maximize opportunities for effective sleep and rest • Maximize safety for staff • Maximize safety for patients • Maximize safety for family/friends • Minimize manual handling • Maximize the legibility of the space
Include multipurpose circulation spaces	Support the use of corridors as unofficial social spaces, storages spaces, therapy areas, and so on. This may encourage patients to emerge from their rooms and engage in incidental practice.	• Maximize the versatility of the space • Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Maximize accessibility within the building
Maximize outdoor and green spaces	Incorporate outdoor spaces and provide views of nature from patients' rooms, therapy areas, and communal areas. Outdoor spaces provide opportunities for "real-world" practice, and public access can facilitate interaction with the community. Nature can also be rejuvenating and relaxing.	• Maximize the versatility of the space • Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Foster emotional well-being for staff • Foster emotional well-being for patients • Foster emotional well-being for family/friends • Maximize integration with the community
Maximize personal control over the space	Patients, staff, and visitors should be able to execute personal choices in regard to their environment. This will allow users to maintain a sense of control and	• Maximize the versatility of the space • Maximize opportunities for practice of physical function

(continued)

Table 5. (continued)

Means Objective	Description	Is a Means to Achieving the Following Objectives
	to create a balance between relaxing versus stimulating and private versus social and to create age-appropriate spaces as needed.	• Maximize opportunities for practice of cognitive function • Foster emotional well-being for staff • Foster emotional well-being for patients • Foster emotional well-being for family/friends
Maximize integration with the community	Close to transport and community services. Provide services that contribute to the community, create a sense of normalcy and “home,” encourage visitors, and provide opportunities for therapeutic practice of everyday skills.	• Minimize time • Maximize opportunities for practice of cognitive function • Foster emotional well-being for staff • Foster emotional well-being for patients • Foster emotional well-being for family/friends
Maximize aesthetics	Beauty or attractiveness in the building, including views, interior design, and artwork. Aesthetics may be associated with any of the senses (sight, sound, smell, touch, and taste). This can encourage visitors and foster users’ emotional well-being.	• Foster emotional well-being for staff • Foster emotional well-being for patients • Foster emotional well-being for family/friends • Maximize integration with the community
Maximize indoor environmental quality	This includes air quality, light levels, access to natural light, ceiling heights, sound levels, views of the outdoors, and orientation to the sun. In addition, the indoor environment should suit specific needs of patients with brain injury who may have sensory or perceptual differences.	• Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Foster emotional well-being for staff • Foster emotional well-being for patients • Foster emotional well-being for family/friends • Maximize safety for staff • Maximize safety for patients • Maximize safety for family/friends
Maximizing the legibility of the space	A legible space is easy to navigate and understand. Wayfinding should be intuitive for all users. This is not just about signage; environmental cues are also important. Consideration should be given to people with low literacy, people who do not speak English, and people with cognitive, visual, or other sensory impairments.	• Minimize cost • Minimize time • Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Foster emotional well-being for staff • Foster emotional well-being for patients • Foster emotional well-being for family/friends • Maximize safety for staff • Maximize safety for patients • Maximize safety for family/friends
Maximize accessibility within the building	Staff, patients, and visitors should be able to independently access the necessary parts of the facility in a timely fashion. Colocation of facilities, journey time within the building, access to services, and disability access should all be considered. Rather than being	• Minimize cost • Minimize time • Maximize opportunities for practice of physical function • Maximize opportunities for practice of cognitive function • Foster emotional well-being for patients

(continued)

Table 5. (continued)

Means Objective	Description	Is a Means to Achieving the Following Objectives
	organized around the 9–5 working day, services such as cafés should also be open at times that coincide with visiting hours (e.g., evenings and weekends).	• Maximize safety for staff • Maximize safety for patients • Maximize safety for family/friends • Maximize the legibility of the space
Minimize manual handling	Staff should need to do minimal manual handling of patients and equipment. Requires suitable technologies (e.g., hoists, trollies) and design choices (e.g., easily accessible equipment, storage spaces, and minimal distances between key services).	• Maximize safety for staff • Maximize safety for patients
Maximize sight lines	Users should easily be able to see across key spaces. However, the objective of maximizing sight lines needs to be weighed up against the need for private spaces.	• Maximize safety for patients • Maximize the legibility of the space
Meet hospital safety guidelines	Should meet or exceed the building safety requirements or guidelines as laid down by the appropriate governing agency.	• Maximize safety for staff • Maximize safety for patients • Maximize safety for family/friends

aspects of care delivery including administrative tasks. The location of services within the building, and the location of the building itself, may impact the efficiency of communication between services, travel time to and within the building and therefore the time taken to execute all tasks.

The participants decided that an efficient rehabilitation facility should also *maximize the responsiveness of the space*. A responsive space was defined as a space that can change in response to users' changing needs. Different cohorts of staff, patients, and visitors will have different needs, and these needs may change over time. A rehabilitation nurse noted, "We get some patients that are so cognitively impaired . . . and then we have other types of patients that have just got speech issues . . . but their cognitive and mobility function is high. So it [the design] would have to be adaptable . . ." The participants agreed it would be most efficient for the building to respond to changes as they occur, hence the means objectives to *maximize the adaptability of the space* and *maximize the versatility of the space* (see Table 5 and Supplementary Material).

Maximize effectiveness. The participants agreed that an inpatient stroke rehabilitation facility should *maximize the clinical effectiveness* of rehabilitation (see Figure 2). The participants felt that an optimal rehabilitation facility should therefore *maximize patients' incidental and deliberate practice of any activity that promotes recovery, so that they can reach their optimal physical, psychological, and social function*. In other words, the built environment should facilitate guided practice while in therapy but also encourage patients to voluntarily or incidentally participate in recovery-promoting activities (physical, social, cognitive) outside of the limited formal therapy time.

. . . the built environment should facilitate guided practice while in therapy but also encourage patients to voluntarily or incidentally participate in recovery-promoting activities (physical, social, cognitive) outside of the limited formal therapy time.

In addition, the built environment should be designed to *maximize patients' effective sleep and*

rest. Sleep disorders are common poststroke, and disturbed sleep may negatively impact short- and long-term recovery (Duss et al., 2017). Many aspects of the built environment, including noise, light, temperature, and the presence of other people, may negatively affect sleep, and so should be considered in the design of rehabilitation facilities.

The means objective to *maximize personal control over the space* (i.e., allow patients, staff, and visitors to execute personal choices about their environment) may be instrumental to maximizing clinical effectiveness (see Table 5 and Supplementary Material). Having personal control would allow patients, staff, and visitors to adjust the space to respond to changing and varied needs in therapy. In addition, a sense of agency may help patients to feel motivated, and, according to the Theory of Supportive Design, may reduce stress (Ulrich, 1991).

Foster emotional well-being. The workshop participants specified that the design of inpatient stroke rehabilitation facilities should *foster the emotional well-being* of all users. The term “emotional well-being” in this context encompasses feelings of self-confidence, self-worth, self-determination, belonging, optimism, happiness, and dignity. Critically, by fostering emotional well-being, detrimental cognitive or emotional states such as boredom, anxiety, and stress may be minimized (Luker, Lynch, Bernhardsson, Bennett, & Bernhardt, 2015). A stroke survivor highlighted the importance of patients’ emotional well-being, and its connection to *effectiveness* and *efficiency*, by stating that, “There were days when I was too down in the dumps to even do as much physio [physiotherapy] as I could be doing, so your physio [physiotherapist] is spending a bit more time sitting there talking with you, rather than getting up and doing the physical things, so I think that emotional well-being is really important . . .”

“There were days when I was too down in the dumps to even do as much physio [physiotherapy] as I could be doing . . .”

The participants emphasized that the *emotional well-being* of any one group of users

(*patients, visitors, and staff*) can influence the emotional well-being of the others. Critically, “the staff have to feel good in order to do a good job” (stroke rehabilitation researcher and physiotherapist). The participants reported that the means of achieving emotional well-being may differ between cohorts (e.g., patients may respond to different things compared to staff), so the needs of all three groups must be considered when design choices are made.

The means objective to *maximize the legibility of the space* (i.e., have good wayfinding and ensure the space is easy for all users to navigate) may help to reduce stress and improve emotional well-being. Getting lost or disorientated and having to walk further can sap energy and impact pain levels. *Maximize integration with the community* was also included as a means objective that may help to promote emotional well-being (see Table 5 and Supplementary Material).

Maximize safety. All workshop participants agreed that the *safety of patients, visitors, and staff* was fundamentally important in the design of a rehabilitation facility. The design should ensure the basic safety of all occupants (e.g., fire safety and evacuation, heating/cooling). A stroke survivor remarked that “Safety is one of those things where there’s got to be a minimum level, [because] things just don’t *work* below that level.”

The participants emphasized that some threats to safety may be of more concern in a stroke rehabilitation facility than in other healthcare settings, and the means of achieving safety may therefore be different too. The workshop participants agreed that patient falls may be the biggest threat to patient safety in a stroke rehabilitation facility. Stroke patients can experience physical and cognitive changes that may increase their risk of falling, including impaired balance, hemiplegia, muscle weakness, and/or hemi-inattention or extinction in one or more of their senses. Hemiplegia, for example, may prevent a patient from self-protecting upon falling.

However, the workshop participants emphasized that the balance between safety and activity restriction is very delicate. Restricting patient activity and practice in order to prevent falls

could be counterproductive and detrimental to patients' recovery and safety in the long run. A rehabilitation nurse noted that, "in rehab they take risks. They're [patients are] not going to learn without it" An architect and researcher in learning environments similarly noted that, "safety, while it's important, it's kind of like with children in school settings as well, a little bit of risk is okay as long as people understand it"

... the balance between safety and activity restriction is very delicate.

Participants agreed that safety measures that confine patients to their rooms, or somehow limit patients' control over their movement through the facility, would be detrimental to patients' clinical outcomes and emotional well-being, and so would not meet the fundamental objectives to *maximize effectiveness* and *foster emotional well-being*. Facility design should provide opportunities for learning and recovery in addition to the necessary health and safety requirements. The means objectives associated with achieving patient safety were therefore carefully chosen to ensure patient safety without discouraging patient activity and practice (see Table 5 and Supplementary Material).

Discussion

This study is novel in its methodology and its outcomes. We have made the following original contributions to the literature: (1) We have developed a framework of what experts think is important in the design of inpatient stroke rehabilitation facilities, (2) we have begun to reconceptualize rehabilitation facilities as learning environments, and (3) we have applied Value-Focused Thinking to facilitate systematic, interdisciplinary design research.

A Framework for Inpatient Stroke Rehabilitation Facility Design

According to our framework, it is fundamentally important that the design of inpatient stroke rehabilitation facilities maximizes the efficient running of the facility, patients' clinical outcomes, the

emotional well-being of all users, and the safety of all users. The 14 identified means objectives suggest how these fundamentally important things could be achieved. Many of the objectives identified in this study are backed by previous healthcare design research and theory in nonrehabilitation health settings (for a scoping review protocol of theories used in healthcare design research, see Shannon, Nordin, Anåker, Bernhardt, & Elf, 2017). For example, the Theory of Supportive Design emphasizes the importance of personal control, social support, and positive distraction (Ulrich, 1991), and these concepts are represented in our framework by the means objectives to *maximize personal control*, *maximize integration with the community*, and *maximize aesthetics*, respectively.

Our framework has been designed to be specific to inpatient stroke rehabilitation, and it therefore includes concepts that do not appear in existing healthcare design frameworks (Zhang, Tzortzopoulos, & Kagioglou, 2018). The unique position of rehabilitation facilities as learning environments was emphasized in our framework by the importance assigned to *opportunities for incidental and deliberate practice of physical, cognitive, and social activity*. This importance was emphasized by health environments experts and learning environments experts. Self-directed learning is a central tenant of adult learning theory (Merriam, 2001), and rehabilitation guidelines emphasize the importance of the patient's input in repetitive, goal-directed practice post-stroke (Winstein et al., 2016). The concept of flexible spaces, and the distinction between adaptability and versatility, is also emphasized in learning environments research (see, e.g., Cort, Cort, & Williams, 2017), and this contribution to the framework was made by a participant with expertise in learning environments research.

A review by Luker, Lynch, Bernhardtson, Bennett, and Bernhardt (2015) found that although stroke patients recognize that physical activity is important for their recovery, they feel that their physical activity (both in structured therapy and in free time) is negatively impacted by their boredom, lack of motivation, and their perceived lack of autonomy. Many of the means objectives in our framework could facilitate

stroke patient autonomy and promote their physical and cognitive practice, for example, *maximize personal control over the space* and *maximize accessibility within the building*. Our framework therefore suggests that rehabilitation environments should be designed to draw patients out of their bedrooms and to support patient autonomy and activity, while ensuring that they remain safe. Safety is fundamentally important, but it should not preclude opportunities for practice, as this is essential for patients' recovery.

...rehabilitation environments should be designed to draw patients out of their bedrooms and to support patient autonomy and activity, while ensuring that they remain safe.

Our framework suggests that design choices that are usually standard in acute healthcare settings may need to be rethought for rehabilitation. Patient room occupancy is an example of this. Evidence from acute healthcare populations suggests that single-occupancy rooms are beneficial for infection control, patient-clinician communication, noise reduction, and that they are preferred by patients (Ellen, Alan, & Melissa, 2018). Stroke patients are not usually at high risk of infection, are often well enough to access spaces beyond their room, and many stroke patients value camaraderie with their peers (Bennett, Luker, English, & Hillier, 2016; Lewinter & Mikkelsen, 1995). According to our framework, a patient's room in an inpatient stroke rehabilitation facility should encourage physical, cognitive, and social activity; be conducive to sleep and rest; promote well-being; be responsive to the user; reduce travel time; reduce costs; and maximize safety (primarily falls risk). There is no clear evidence to support whether single-occupancy or multiple-occupancy rooms are the optimal way to meet these fundamental objectives in rehabilitation facilities (Shannon et al., 2018). Architects and designers may choose to design rehabilitation patient rooms to meet the objectives in our framework—whether they be single occupancy or multiple occupancy—instead

of routinely applying the patient room model that is accepted in acute care.

...design choices that are usually standard in acute healthcare settings may need to be rethought for rehabilitation.

Benefits of an Interdisciplinary, Value-Focused Thinking Methodology

Healthcare environments are complex. The interdependence of clinical processes, the built environment, and human behavior presents a challenge for traditional approaches of isolating variables and identifying causation (Stichler & Hamilton, 2008). Hamilton (2013) has argued that the field of evidence-based design has been done a disservice by attempts to confine it to reductionist philosophies of science. Rather than attempting to simplify the topic, we embraced the complex, subjective nature of rehabilitation facility design. We recruited an interdisciplinary team of experts ranging from academics, to stroke survivors, to clinicians, to architects. Many of the experts had relevant dual expertise, which reinforced the interdisciplinarity of the cohort.

Interdisciplinary research carries challenges in terms of language and communication (Bracken & Oughton, 2006). We therefore incorporated measures to ensure that everyone was understood, such as the glossary of jargon (and permission to call it out) and the Workshop 1 prereading. Compared to alternative-focused thinking, Value-Focused Thinking encourages the decision maker to think beyond specific design features (Keeney, 1992). This encouraged unconstrained, nontechnical thinking that was accessible to all participants. Value-Focused Thinking presented the experts with a cohesive, inclusive approach that minimized the impact of discipline biases and ensured that all opinions were heard.

Rather than focusing on one variable (e.g., social support or integration with the community), the framework acknowledges that many interconnected variables are important for inpatient stroke rehabilitation facility design. Each of these objectives is important in its own right despite conflicts or interdependencies between

objectives. Healthcare architects, designers, and stakeholders should consider combinations or “bundles” of design solutions to collectively meet desired outcomes in the built environment (Hamilton, 2010). Value-Focused Thinking can aid this process by articulating priorities and organizing them into a framework, so that they can be considered systematically.

Limitations

The choice to have many disciplines represented at the workshops meant that there were between two and six experts from each discipline in the final sample (see Table 2). A key strength of this study lies in its interdisciplinarity. Future studies could consider repeating each workshop and increasing the total number of participants in order to include more experts and more disciplines, such as occupational therapists, speech pathologists, health administrators and managers, educators, and the full complement of rehabilitation staff. There was generally a high level of agreement between participants in this study, so whether adding more disciplines would raise additional themes to those found to date is unknown.

Some participants in this study had collaborated previously. This familiarity may have helped to stimulate discussion, but a downside is that this sample may not represent the views of an international, varied cohort. Future studies could consider alternative methods of recruitment (e.g., advertising on social media or academic networking websites) to widen the pool of experts and bring an international perspective. Such recruitment methods would require a selection process to ensure expertise.

Future Directions

This study presents only the first step in an ongoing process to reframe stroke rehabilitation spaces and inform their design. Expert elicitation could be further utilized to rank the fundamental objectives identified in this study in order of their relative importance to indicate how potentially conflicting objectives should be prioritized in design (Belton & Stewart, 2002).

The current framework could inform postoccupancy evaluation protocols or detailed case study research on-site at existing rehabilitation facilities. Future research could refine the framework by considering specific spaces (e.g., bedroom, gym, corridors) as well as the overall facility design. Critically, the priorities identified in this study are relevant for the *built environment* of rehabilitation facilities and do not necessarily reflect *clinical* priorities for rehabilitation. Future research should acknowledge the clinical priorities and culture of the facilities. Future research could provide and test design exemplars of how objectives could be met.

Conclusions

The Value-Focused Thinking methodology used in this study could be applied to any complex built environment, including other healthcare environments and other rehabilitation environments, such as community rehabilitation or the patient’s own home. The objectives in the framework reflect the unique needs of stroke rehabilitation as both a healthcare space and a learning space. The challenge for providers compiling design briefs is to emphasize the importance of these objectives in stroke rehabilitation environments, and the challenge for architects and designers is to find design solutions that collectively meet these objectives.

Implications for Practice

1. Inpatient stroke rehabilitation facilities are unique healthcare environments, and design choices that are standard in acute healthcare settings may need to be reframed for rehabilitation settings.
2. Designers of stroke rehabilitation facilities should consider how designs can provide opportunities for physical, cognitive, and social activity.
3. Rehabilitation environments should allow for carefully monitored risk-taking to promote patient autonomy and activity while maintaining patient safety.

4. Rehabilitation facility design may benefit from interdisciplinary input from learning environments research and healthcare environments research.
5. Value-Focused Thinking is an effective methodology to facilitate interdisciplinary research, bring together varied perspectives, and consider complex problems in a design context.

Authors' Note

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Supplemental Material

Supplemental material for this article is available online.

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3.4 Further results

The final hierarchy of fundamental objectives and the network of means objectives was depicted in a figure in the supplementary materials of the manuscript. That figure is included here for completeness (see Figure 3.1). The fundamental objectives in this figure are defined in the results section of the manuscript. The means objectives are defined in brief in Table 5 of the manuscript and in full in the supplementary material (Appendix 6). It is worth noting that the patient-specific criteria in this framework (namely, physical and cognitive practice, sleep and rest, and emotional well-being) endorse the importance of patients' behaviour and emotional well-being in the learning process post-stroke.

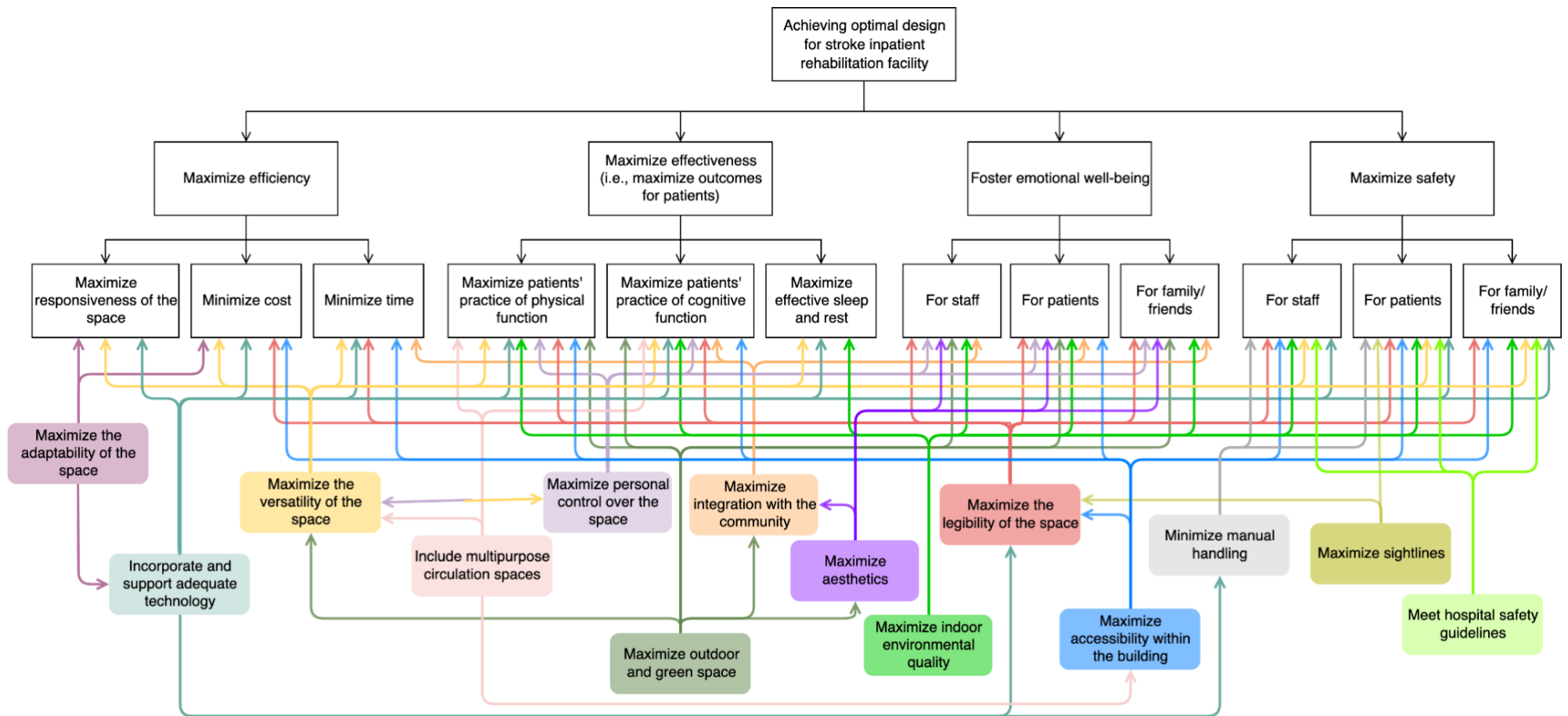


Figure 3.1 The framework of what is important in the physical environment of inpatient stroke rehabilitation facilities.

This framework includes the hierarchy of fundamental objectives (four first-tier fundamental objectives and the 12 second-tier fundamental objectives), the network of 14 means objectives, and the connections between the hierarchy and the network as they were identified in the workshops.

Some additional activities were completed in the interdisciplinary workshops, which were not included in the published manuscript. After finalising the hierarchy of fundamental objectives and the network of means objectives in Workshop 2, the workshop attendees were asked to brainstorm different research methods and measurement tools that could be used to investigate the objectives. Each of the suggested methods and measures are described in full in the workshop 2 summary document in Appendix 5. These suggested methods and measures were then compiled into a table to illustrate the relative strength of each of the approaches indicated by the workshop attendees (see Table 3.1). Mixed methods approaches were considered the most useful (marked in green in Table 3.1) and this informed the mixed methods design and selection of measurement tools used in Study 3 (see Chapter 4). Table 3.1 is not intended to be a complete list of possible methods or measurement tools that could be used in rehabilitation environments research. It is the result of a brainstorming activity and is included here to illustrate the start of the process by which methods and measures were chosen for Study 3.

Table 3.1 Research methods and measurement tools suggested by the workshop attendees.

Key		Fundamental objectives								
		Efficiency			Effectiveness			Emotional well-being		
		Responsiveness			Physical activity			For staff		
		Cost	Time		Cognit. activity	Sleep & rest		For patients	For family	Safety
Research methods and measurement tools	Checklist	Medical-surgical patient room (CHD)								
		Safety risk assessment (CHD)								
		AEDET								
		ASPECT								
		Health department building standards								
	Accreditor	LEED								
		Green star rating accreditation								
		WELL criteria								
	Questionnaires	Purpose-designed survey								
		Planetree questionnaires								
		Satisfaction questionnaires								
		PHEQI								
		SHEDS								
	Monitor behaviour	Time & motion study								
		Behavioural mapping								
		User activity observation form								
		Activity monitoring (accelerometer)								
		Motion tracking								
		Physiological monitoring								
	Qualitative methods	Eye tracking								
		Qualitative interviews								
		Roving qualitative interviews								
	Clinical or operational audit	Photo elicitation								
		Staff turnover and sick leave								
		Count single and shared bedrooms								
		Count visitors								
		Count wayfinding queries								
		Count code greys (personal threat)								
		Count reported risks/near misses								
		Reported injuries								
		Falls per 1000 bed days								
		Length of stay								
		FIM efficiency								
		Discharge destination								
		Medication for depression								
	Spatial analysis	Space syntax								
		Space use coefficient								
	Modelling	Agent based (computer) modelling								
		Living lab								
	Mixed methods	Health economics analysis								
		Monitor behaviour + qual. methods + audit								
		Questionnaire + qualitative methods								
		Operational audit + checklist + modelling								

Acronyms: CHD = Centre of Healthcare Design; FIM = Functional Independence Measure, LEED = Leadership in Energy & Environmental Design; AEDET = Achieving Excellent Design Evaluation Toolkit; ASPECT, PHEQI = Perceived hospital environment quality indicators; SHEDS = Supportive Hospital Environment Design Scale.

3.5 Chapter summary and conclusions

This chapter contains a framework of what is important in the physical environment of inpatient stroke rehabilitation facilities for learning and recovery after stroke. This framework begins to address the question of how rehabilitation facilities could be designed to be fit for purpose. The criteria in the framework cannot be considered in isolation. Rather, each criterion should be considered in context as it relates to every other criterion. The framework does not suggest specific ambient, architectural, interior, or maintenance features that should be included in the physical environment to meet each objective: it provides a structure for interrogating the internal and external factors in this interconnected, complex system.

4 Study 3: A mixed methods multiple-case study

4.1 Chapter overview

This chapter covers the methods used for Study 3, which was a convergent mixed methods multiple-case study where the cases were two rehabilitation facilities in Victoria, Australia. The rationale, research questions, and methodological approach for this study are provided in the first three sections of this chapter. The next sections outline how the cases and participants were selected, the data collection methods, measurement tools, and analysis procedures. Study 3 was named ‘ENVironments for Inpatient RehabilitatiON of Stroke patients’, or the ENVIRONS study. The ethics approvals for this study are in Appendix 7. The criteria used to select the two cases are in Appendix 8. The questionnaire booklets, interview schedule, and behavioural mapping data collection form are in Appendices 9, 10, and 11 respectively. The results of Study 3 are presented in Chapters 5 to 7. The following checklists were referred to when designing the methods and reporting the results of study 3: The consolidated criteria for reporting qualitative research (COREQ; Tong, Sainsbury, & Craig, 2007), the standards for reporting qualitative research (SRQR; O’Brien, Harris, Beckman, Reed, & Cook, 2014), and guidelines for reporting mixed methods research (Leech & Onwuegbuzie, 2010; O’Cathain, Murphy, & Nicholl, 2008).

4.2 Study rationale

Case studies are appropriate for researching complex systems in healthcare (Byrne, 2002; Byrne & Callaghan, 2013; Long et al., 2018). They are the best methodological approach when 1) the researcher has very little or no control over the

system or behaviours that are being studied, 2) the researcher suspects that there may be many interdependent variables involved, and 3) the researcher suspects that the context of the system or behaviour is likely to be pertinent to the research (Byrne & Ragin, 2009; Yin, 2017). Stroke rehabilitation environments research satisfies all three of these criteria (see Chapter 1). Study 3 therefore took a case study approach to addressing the primary aim of this thesis: to explore the role of the physical environment in inpatient stroke rehabilitation as it relates to patient recovery and re-learning (see Section 1.6).

Case studies can benefit from a predefined focus or framework (Crowe et al., 2011). Following on from the previous study (Chapter 3), which utilised expert elicitation, this study focused on the patients' experience and perspective. The intention of Study 3 was to bring stroke patients to the fore, and acknowledge both the patient and the physical environment in the inpatient rehabilitation process (see Figure 1.1). As mentioned in Chapter 1, Person-Environment Fit theory acknowledges the importance of the personal, or internal factors in the interaction between environment and behaviour. This theory therefore lends itself to a patient-focused approach and so was an appropriate choice to inform the research questions and the interpretation of results in Study 3.

Patients' behaviour and emotional well-being are central to their rehabilitation (see Section 1.2). Behaviours beneficial to the rehabilitation process include physical, cognitive, and social activity, and sufficient sleep and rest (see Sections 1.2.1 and 3.3). An optimal emotional well-being includes having a positive mood (i.e., not depressed, anxious, or stressed), feeling motivated, and not feeling bored (see Section 1.2.2 and 3.3). Person-Environment Fit theory proposes that a patient's behaviour and

emotional well-being are products of the fit between the patient's competencies (internal factors) and their environment (external factors) (see Section 1.3.2).

The framework developed in Study 2 corroborates and expands on the constructs in Person-Environment Fit theory (see Figure 3.1). Like Person-Environment Fit theory, the framework highlights the importance of patients' behaviour and emotional well-being, but it also suggests additional criteria directly related to the patients' experience, such as safety. The framework also helps to define the type of patient behaviour that is important in rehabilitation, namely, patients' physical and cognitive (including social) activity, and patients' sleep and rest. Figure 4.1 shows a simplified version of the framework, which highlights the objectives that directly relate to the patients' experience, as opposed to the objectives that are related to the experiences of clinical staff (emotional well-being and safety), visitors (emotional well-being and safety), or healthcare managers, planners, or funders (efficiency). In light of this framework, patient safety was included as a construct in Study 3, alongside the constructs that are central to Person-Environment Fit theory, namely, patient competencies, physical environment, behaviour, and emotional well-being (see Figure 4.2).

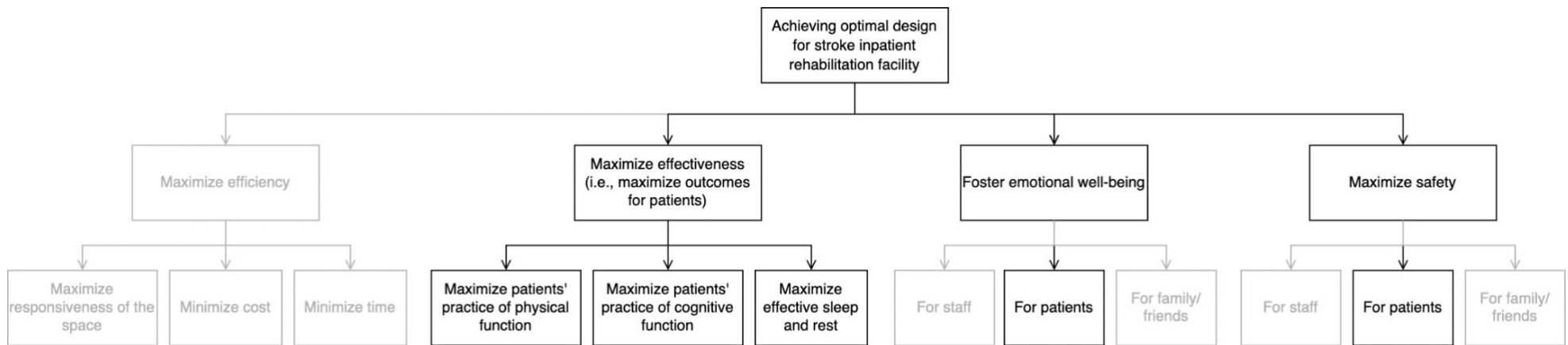


Figure 4.1 The fundamental objectives that relate directly to stroke patients.

The framework developed in Study 2 defined fundamental objectives that are important in the physical environment for re-learning and recovery after stroke. The objectives that are not directly related to the stroke patients are greyed-out.

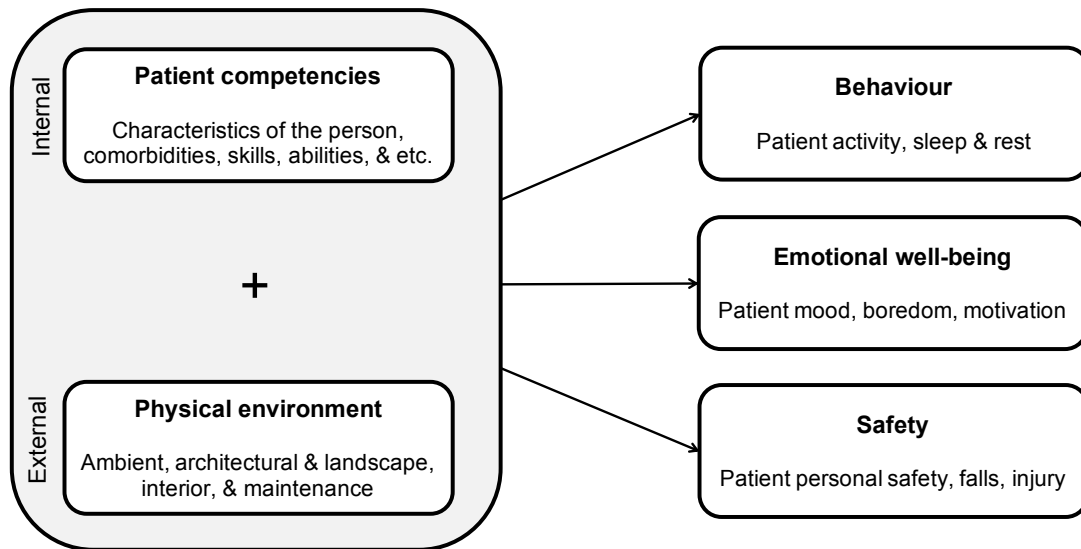


Figure 4.2 The constructs that frame the case studies in Study 3.

These constructs reflect the tenets of Person-Environment Fit theory and the patient-related criteria in the framework developed in Study 2. Patient competencies, the physical environment, behaviour, and emotional well-being are central to Person-Environment Fit theory. Safety is not highlighted in Person-Environment Fit theory, but is included here because behaviour, emotional well-being, and safety are emphasised in the framework developed in Study 2. Together, the constructs in this figure define the direction and boundaries of the case studies that were conducted in Study 3 to explore the role of the physical environment in stroke rehabilitation.

In Study 3 of this thesis, both qualitative and quantitative methods will be used to address each of the constructs in Figure 4.2, and their results will be merged in a mixed methods analysis. Mixed methods research brings qualitative and quantitative methods together to complement and strengthen each other; the quantitative aspects of the research can bring precision, while the qualitative aspects can add meaning (Creswell & Plano Clark, 2018). A mixed methods design therefore creates opportunity to gain greater insights about the patient-environment relationship than either quantitative or qualitative methods alone. In this study, patients' behaviour, emotional well-being, and safety will be described (quantitatively) *in context*, with (qualitative and quantitative) details about the physical environment.

This description will be merged with (qualitative) information about patients' experiences to gain a more complete understanding of the role of the physical environment in stroke patient's behaviour, emotional well-being, and safety in inpatient rehabilitation. The mixed methods research design used in Study 3 will be described in more detail in Section 4.4.

4.3 Research questions

Study 3 was driven by three research questions, relating to the overall aim of the thesis to explore the role of the physical environment in stroke rehabilitation. Each of these research questions addressed the constructs in Figure 4.2: patient competencies, the physical environment, behaviour, emotional well-being, and safety. A qualitative approach was used to address research question 1, and a quantitative approach was used to address questions 2a to 2c. The qualitative and quantitative results were merged to address question 3, reflecting the mixed methods design of the study and bringing a more complete understanding of the role of the physical environment in stroke patient's behaviour, emotional well-being, and safety in inpatient rehabilitation. The three research questions were:

- 1) What are stroke patients' experiences of the physical environment of current inpatient rehabilitation facilities? Specifically, how do they experience these environments in the context of their behaviour (activity and sleep), their emotional well-being, and their safety? Do these experiences vary depending on patient competencies?

- 2) What is the nature of patients' behaviour, emotional well-being, and safety in the physical environment of current inpatient rehabilitation facilities? Does this vary depending on patient competencies?
 - a) How much physical, cognitive, and social activity do patients get in these spaces? Where do these activities occur? How much sleep do they get? How good is their sleep quality?
 - b) How do patients feel in these spaces? How is their mood (depression, anxiety, stress), boredom, and motivation?
 - c) How many falls and subsequent injuries do patients experience in these spaces? Where and how do these falls occur?
- 3) How do stroke patients' experiences of the physical environment of inpatient rehabilitation facilities, and the nature of their behaviour, emotional well-being, and safety in these spaces, help to explain the role of the physical environment of inpatient rehabilitation facilities in patients' behaviour, emotional well-being, and safety after stroke?

4.4 The methodological approach

Mixed methods designs are often incorporated in other research designs, such as evaluation studies, action research, grounded theory, or case studies to name a few (see for example Brady et al., 2011; Johnson, McGowan, & Turner, 2010; Phillips & Davidson, 2009; Poltawski et al., 2013). These integrations have been referred to as 'complex' mixed methods designs (Creswell & Plano Clark, 2018; Plano Clark & Ivankova, 2016). This present section focuses on the methodological approach of mixed methods multiple-case study research used in Study 3, rather than on the specific qualitative methods and quantitative measures used to collect the data and

address the research questions in this study. The qualitative methods and quantitative measures are described later, in Section 4.8.

4.4.1 ***Convergent mixed methods***

There are many different mixed methods research designs and the parameters of these are constantly being refined. In general, mixed methods designs differ from each other in the following ways: 1) their intent, i.e., the reason for bringing together qualitative and quantitative data, 2) the relative timing of the qualitative and quantitative aspects of the study, i.e., sequential or parallel, and 3) the relative priority that is assigned to the qualitative and quantitative aspects of the study. In terms of intent, Creswell and Plano Clark identify three different types of mixed methods designs: 1) convergent designs which combine qualitative and quantitative data to form a more complete understanding of a problem or to corroborate results, 2) explanatory designs which use qualitative data to explain quantitative results, and 3) exploratory design which use quantitative methods to build on qualitative results and explore qualitatively derived hypotheses (2018). The reason for bringing qualitative and quantitative data together in Study 3 was to form a more complete understanding of the role of the physical environment in inpatient stroke rehabilitation in both cases. The qualitative and quantitative data were collected in parallel. Study 3 was therefore a convergent parallel mixed methods design where the qualitative and quantitative components were given equal importance.

The ‘convergent’ mixed methods design has been given various names, including ‘simultaneous triangulation’ (Morse, 1991) and ‘convergence model’ (Creswell, 1999). Essentially, what defines a convergent mixed methods design is that the qualitative and quantitative data are collected and analysed separately before being merged (Creswell & Plano Clark, 2018; Fetters, Curry, & Creswell, 2013). The

qualitative and quantitative research questions in Study 3 (research questions 1 and 2 respectively) largely mirror each other because they both address patients' behaviour, emotional well-being, and safety. Mirroring between the qualitative and quantitative research questions can aid in merging the results and addressing the mixed methods research question (Creswell & Plano Clark, 2018). The process of merging the qualitative and quantitative results in a mixed methods analysis is described in Section 4.10.4.

4.4.2 *Multiple-case study research*

Single case studies present a detailed account of one case, while multiple-case studies, which are sometimes referred to as comparative case studies, present accounts of two or more cases (Mills, Durepos, & Wiebe, 2010). Study 1 revealed marked variability in the design of rehabilitation facilities in Victoria (see Chapter 2). Considering this, it appeared inadequate to include only one facility in Study 3. Yin recommends completing a multiple-case study rather than a single-case study wherever possible because replication of results across cases, or pertinent contradictions between cases, can be beneficial for forming conclusions (2017).

A case study is considered 'embedded' if it includes data from different levels or sub-units within the one case (Yin, 2017). The constructs that framed Study 3 (in Figure 4.2) suggest that data concerning the building should be collected to address the physical environment construct, and that data at the level of the patient should be collected to address the personal competencies, behaviour, emotional well-being, and safety constructs. The two case studies in Study 3 were therefore designed to each have two sub-units of data embedded within them: 1) the building or physical environment sub-unit, and 2) the patient sub-unit. When the data relating to each of these sub-units is brought together, it forms an embedded case study. These sub-units

had different data collection methods and measures, which are described in Section 4.8.

Comparison between cases, or cross-case comparison, highlights similarities and differences between the cases, illustrates overarching themes, and allows tentative conclusions to be drawn about the transferability of results (Yin, 2017). Case study researchers often do not follow formal methodologies when comparing between cases (Ragin, 2014). Indeed, cross-case comparison is not a formal methodology, rather it is simply a term used to describe aggregation at the level of the case. This means that the Study 3 results will be compared and synthesised at the case level, rather than at the variable level, so the qualitative or quantitative patterns between the variables within each case can be taken into account in the synthesis. In short, the cases are the structures within which data are collected and they also provide a comparison mechanism. Cross-case comparison is therefore quite different from other, variable-based methods of aggregating results, such as conventional research synthesis or meta-analysis, which require the researcher to identify key variables and then aggregate the data for each variable in turn (Cooper, Hedges, & Valentine, 2009). Yin argues that variable-based approaches to synthesis disregard the context and the holistic nature of cases, thereby ignoring this most intrinsic and valuable feature of case study research (2017).

Data were collected concurrently for the two case studies in Study 3 and were analysed separately within the respective cases. To conduct the cross-case comparison, similarities or differences between the two cases were continually noted, as described further in Section 4.10.3. This was an iterative process that began during data collection and continued throughout analysis. Figure 4.3 shows the steps

involved in conducting this convergent parallel mixed methods embedded multiple-case study.

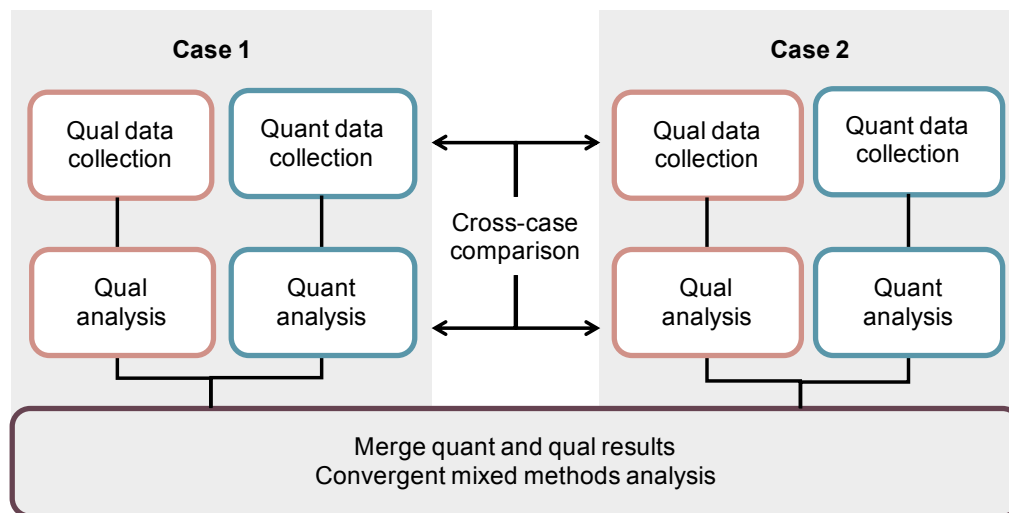


Figure 4.3 The steps involved in Study 3.

Study 3 was a convergent parallel mixed methods embedded multiple-case study. Qualitative (Qual) and quantitative (Quant) data were collected to address the research questions and therefore covered both of the subunits within the cases (the physical environment and the patients). The qualitative and quantitative data were collected and analysed in parallel for each case separately. The qualitative and quantitative results were then merged in a convergent mixed methods analysis. The two cases were compared to each other throughout.

4.5 Selecting the cases

Prior to conducting Study 3, suitable case facilities needed to be selected from the large population of inpatient rehabilitation facilities. Yin takes a pragmatic stance and recommends choosing cases that 1) will best illuminate your research question and 2) that you have access to for data collection (2017). To facilitate access, the choice of rehabilitation facilities was limited to the state of Victoria (see Section 2.2). The results of Study 1 revealed variation between the rehabilitation facility buildings

in Victoria on all of the variables measured, including when they were built, whether they were purpose built, their size, layout, etc. (see Chapter 2). In the face of such variation, it was not immediately clear which facilities would 1) best answer the research questions and 2) provide ease of access. Value-Focused Thinking was used to make this decision. Value-Focused Thinking is explained in detail in the manuscript in the previous chapter (Section 3.3). In short, it is a structured decision-making process that asks the decision-maker to focus on the values behind their decision, before considering the possible alternatives (Keeney, 1992). It can be used by an individual decision-maker, or by a group (Keeney, 1992).

The Value-Focused Thinking process produced a set of criteria, which are detailed in Appendix 8. Each of the 64 rehabilitation facilities in Victoria was considered in light of these criteria. The aim was to identify facilities that met key criteria and that were similar to each other in most respects, but different from each other in a few key ways thereby ensuring some variation between the cases to aid comparison between them. This process produced a shortlist of ten potential case facilities. I visited each of these facilities in person to get an impression of the different environments, and then contacted staff members at six of these facilities. The final two were chosen based on staff interest in participating (as specified in the criteria in Appendix 8). These two facilities were St George's Hospital (Case 1, SG) and Bendigo Hospital (Case 2, BH). Whilst being similar to each other in key ways (publicly funded, not purpose built, similar ward size), these two facilities differed in location (metropolitan versus regional) and age (older build versus newer). The two facilities are described in detail in Chapter 5.

4.6 Patient eligibility

Current inpatients were asked to participate in both case studies. I approached and recruited all the participants while they were on the ward. Before recruiting patients, I consulted with the clinical staff in relation to any concerns over patients' capacity to participate, and ensured accessibility of research materials for patients with speech or language difficulties (see Section 4.6.1 for details). I did not have a prior relationship with any of the participants. They were informed that their participation would contribute to my PhD research and thesis. The patient eligibility criteria were broad because case study research should be as representative as possible of the setting or population in which it is conducted (Yin, 2017).

Inclusion criteria

- ≥ 18 years of age
- Current inpatient on the rehabilitation ward of one of the two case facilities
- Primary reason for admission to rehabilitation ward is to undergo rehabilitation after a stroke (any type of stroke)
- Admitted to the rehabilitation ward at least 3 days prior to participation, and is expected to remain an inpatient for the duration of their participation

Exclusion criteria

- Severe cognitive or language impairments (e.g., global aphasia or severe comprehension deficits) to an extent that it would preclude participation as identified by a speech pathologist or other member of the clinical team
- Non-English speaking (i.e., require an interpreter)

4.6.1 ***Adapted participation for patients with aphasia***

Participation was adapted to be accessible for the majority of stroke patients, including people with aphasia or other cognitive difficulties. Patients with global aphasia or who were entirely non-verbal were ineligible, but patients who had less severe forms of aphasia were offered the opportunity to participate. Patients with cognitive or language impairments may have unique needs and experiences of the physical environment, and so their opinion and input is vital to forming a complete understanding and for answering the research questions comprehensively. Indeed, Yin recommends that case study research should be as representative as possible of the setting or population in which it is conducted (2017). As well as being representative, the broad eligibility criteria were in the spirit of equitable research. The National Statement on Ethical Conduct in Human Research recommends that people with cognitive impairment are entitled to be given the opportunity to participate in research (2007) .

Prior to providing the patient with written information about the study, a simple comprehension test was performed whereby the patient was asked to repeat back three key components of the study. Eligible patients who failed this comprehension test but were interested in taking part in principle were still able to participate if a proxy provided consent on their behalf. The Participant Information and Consent Form and the Questionnaire Booklet were adapted under the guidance of speech pathologists and aphasia experts with experience in conducting research in this population (Erin Godecke and Sarah D'Souza). The adapted Participant Information and Consent Form had shorter sentences, used the active voice, avoided pronouns, and used everyday words. The wording of the validated questionnaires could not be changed, but the adapted Questionnaire Booklet had larger fonts, put important

information in bold, coloured headings, and included pictures (see Appendix 9). The semi-structured walk-through interview was also designed to be accessible for patients with aphasia, see Section 4.8.2.2. In addition, Sarah D'Souza provided me with training in Supportive Conversation Strategies to facilitate communication with patients with aphasia (see Preface).

4.7 Sampling and sample size

Within each case, the same participants provided the qualitative and quantitative data, except the quantitative data concerning patient safety which was provided by a different cohort (see Section 4.8.2 for further explanation). Having identical samples can facilitate the data merging process (Creswell & Plano Clark, 2018). Nonprobabilistic convenience sampling was used to select the participants. The intention was to approach all stroke patients who were admitted to the case facility during the data collection period. Records were kept of the number of all eligible inpatients during this period, the number of patients approached, the number who declined participation, and the number who consented. These records were used to determine how representative the sample was of the entire eligible population at each case during the period of data collection (see Section 5.3.1, Chapter 5). The number of participants in each case study was based on predicted sample size needed to reach saturation of themes from the interviews (Corbin & Strauss, 2015), the predicted number of eligible patients, and the study time frames.

4.8 Methods of data collection

As outlined above, the following constructs informed the scope of the case studies and the research questions of Study 3: patient competencies, the physical environment, patient behaviour, patient emotional well-being, and patient safety. To address the Study 3 research questions, both qualitative and quantitative data relating to these constructs were collected. This section outlines the qualitative methods and the quantitative measures that were used to collect these data. The data collection was planned to be carried out identically for both cases. I collected all the data independently.

The first section below (Section 4.8.1) describes how data pertaining to the physical environment sub-unit were collected via field notes, photographs, and floor plans (qualitative) and healthcare design checklists (quantitative). The next section (Section 4.8.2) describes how the data pertaining to the patient sub-unit were collected. Data regarding patient competencies were collected via demographic and clinical case report forms (quantitative). To address research question 1 for Study 3 (see Section 4.3), qualitative data regarding patient behaviour, emotional well-being, and safety were collected using semi-structured interviews. Quantitative data concerning patient behaviour and emotional well-being were collected using behavioural mapping and questionnaires, in order to address research questions 2a and 2b, respectively. Quantitative data concerning patient safety were collected via an audit of patient falls to address research question 2c. Figure 4.4 shows all of the data collection methods and measures that were used in Study 3, how they map onto the patient and physical environment constructs, and which research questions they address.

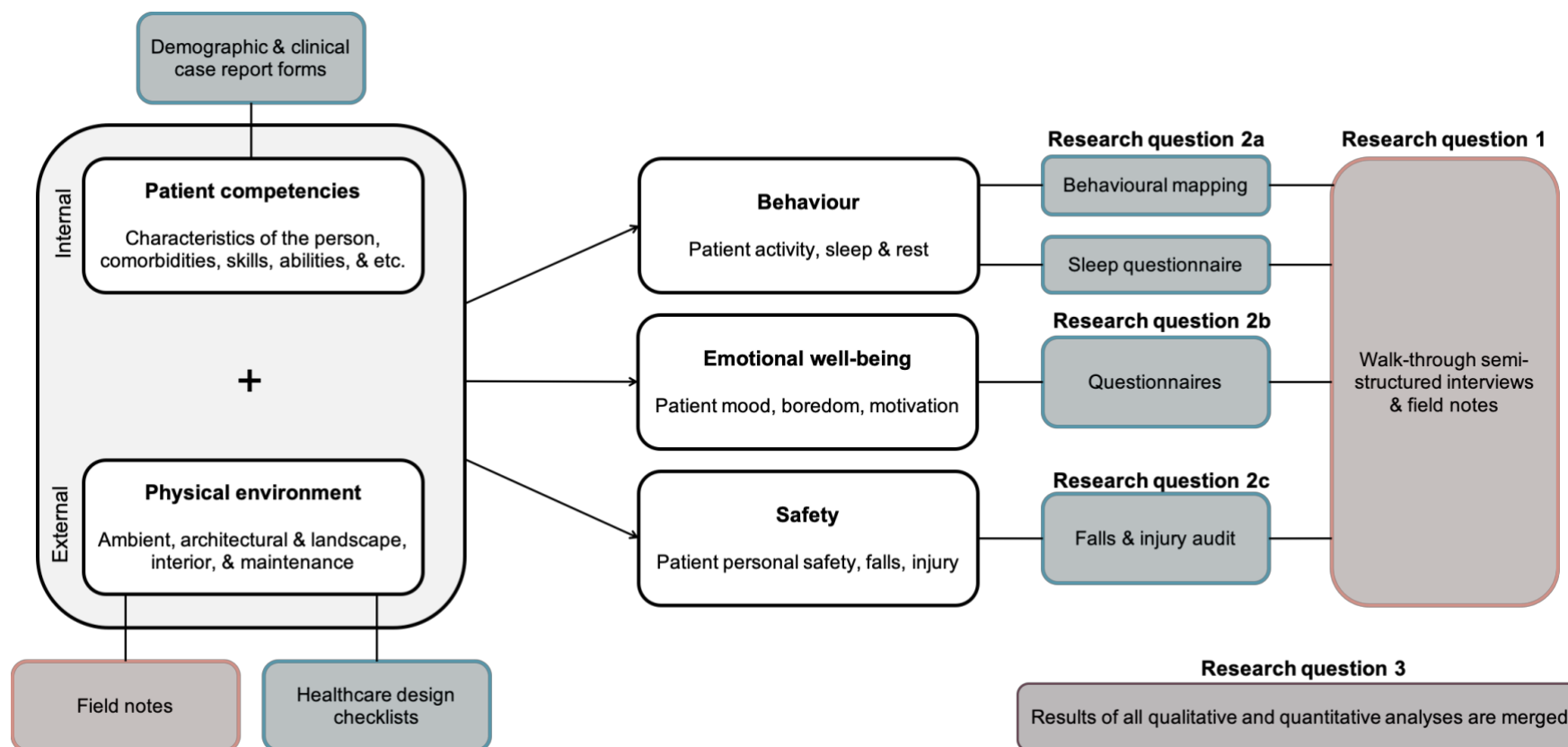


Figure 4.4 The constructs, research questions, qualitative data collection methods, and quantitative measures used in Study 3.

The constructs are in white, the qualitative data collection methods are in pink, the quantitative measures are in blue, and the mixed methods analysis is in purple. The constructs defined the scope of the case studies and the research questions regarding the role of the physical environment (external) and patient competencies (internal) in patient behaviour, emotional well-being, and safety in inpatient stroke rehabilitation. Qualitative methods were used to understand patients' experiences of the environment, thereby addressing research question 1. Quantitative measures were used to explore the nature of patients' behaviour, emotional well-being, and safety, addressing question 2. Mixed methods analysis was used to explain the role of the physical environment of inpatient rehabilitation facilities in patients' behaviour, emotional well-being, and safety after stroke, addressing research question 3.

4.8.1 ***Data pertaining to the physical environment***

Qualitative and quantitative data were collected to address the physical environment sub-unit in both case studies (see Figure 4.4). Qualitative data included description of the physical environment in the form of field notes, photographs, and floor plans. Quantitative data included two healthcare design checklists.

4.8.1.1 ***Field notes, photographs, and floor plans (qualitative)***

Field notes were kept throughout the data collection period at each case. The field notes were descriptive and reflective, with the aim to capture descriptions of the physical environment and interactions between the environment and people (Sanjek, 1990). These field notes formed a living document and were added to at different times of the day, and on weekends and weekdays in order to present a complete picture. Photographs were taken of the physical environment for both cases, including all relevant spaces within the building, such as the clinical areas, therapy areas, outdoor areas, café, etc. For ethical reasons, photographs did not contain any people or identifiable information (e.g., names, patient identifier numbers, etc.). Floor plans were used to consider the layout of the environment: the size of key spaces and their relative position to each other. These field notes, photographs, and floor plans formed the basis of the qualitative descriptions of the physical environment of the building in both cases (see results in Section 5.2, Chapter 5), and began the process of qualitatively comparing between the cases. In addition to these descriptions, all of the information that was collected for each facility in the Study 1 survey (see Table 1 in the manuscript in Section 2.3) was collected for each case and is also included in Chapter 5.

4.8.1.2 *Healthcare design checklists (quantitative)*

Evidence-based healthcare design checklists were sought to quantify the nature and quality of the physical environment at both case facilities. An extensive search of the literature and healthcare design websites revealed no checklists specific to rehabilitation facilities. Correspondence with the authors of a recent systematic review on instruments for assessing the quality of healthcare environments helped to inform which checklists would be most appropriate for the study (Elf, Nordin, Wijk, & McKee, 2017). Two healthcare building design checklists were chosen: The Achieving Excellence Design Evaluation Toolkit (AEDET Evolution) and the Staff and Patient Environment Calibration Toolkit (ASPECT).

These two checklists were chosen for several reasons. Firstly, they were developed by reputable organisations and are purportedly based on evidence from research. Both checklists were developed by the same collaboration between the National Health Service (NHS) in the UK, Sheffield University, and others (DH Estates & Facilities, 2008a, 2008b). The checklists are designed to complement each other (see below), which is why both were included. They are available online and were accessed for this study in November 2017. The AEDET Evolution was accessed [here](#) and ASPECT was accessed [here](#). Secondly, they have previously been used in healthcare environments research (Abbas & Ghazali, 2011; Ghazali & Abbas, 2012). And lastly, while they are not specific to rehabilitation, each section can be weighted to reflect the relative importance for the specific healthcare setting in question.

The AEDET Evolution is designed to evaluate the design quality of healthcare facilities. It has ten sections: 1) character and innovation, 2) form and materials, 3) staff and patient environment, 4) urban and social integration, 5) performance, 6) engineering 7) construction, 8) use, 9) access, and 10) space. The three sections

relating to engineering and construction quality (i.e., building performance, building engineering, and construction) were not completed as they were outside the scope of Study 3. Each section is comprised of a series of items which can be answered using a six-point scale, between 1 (virtually no agreement) and 6 (virtually total agreement), or the auditor can select a score of 0, which indicates that they cannot determine the rating for this item. The final score for each section is calculated by averaging the score of the items for that section. Items given a score of 0 are excluded from the averaging. Figure 4.5 shows an example of one of the assessment items in the AEDET evolution.

ID	Description	Weighting	Score	Notes
I.01	There is good access from available public transport including any on-site roads <i>Access requirements for staff, patients and visitors arriving at the building using public transport should be thought through. Any on-site roads should be adequate and sensitively designed. Road widths and turning circles should be safe and convenient. Consideration should be given to bringing public transport onto the site where possible and appropriate. Pedestrian routes from public transport points should be clear, safe and sensitively designed. Cars and other vehicles should not dominate the external public areas.</i>	Normal (1) ▼	Select... ▼	

Figure 4.5 An assessment item from the AEDET Evolution

AEDET Evolution = the Achieving Excellence Design Evaluation Toolkit

The ASPECT is designed to expand on section 3 of the AEDET Evolution by providing a more comprehensive evaluation of staff and patient environments. It has eight sections: 1) privacy, company and dignity, 2) views, 3) nature and outdoors, 4) comfort and control, 5) legibility of place, 6) interior appearance, 7) facilities, and 8) staff areas. The scoring system is identical to the AEDET Evolution. Figure 4.6 shows an example of one of the assessment items in the ASPECT. To ensure familiarity with the building, I completed the checklists at the end of data collection period. In addition, I completed a practice version of both checklists prior to the start of the data collection period. This practice version served to familiarise the researcher with the contents of the checklists and the results provided a comparison to the checklists

completed at the end of the data collection period (seven months later). The results of the checklists are included in Section 5.2.2.

ID	Description	Weighting	Score	Notes
2.01	Spaces where staff and patients spend time have windows	Normal (1) ▼	Select... ▼	
<i>Consider using double weighting. While it is pretty obvious that patients' spaces should have windows and natural light, this is not always observed so well for staff. This factor therefore may be of particular importance for spaces where staff work for long periods. This would thus apply even more strongly to staff who have a job that does not normally require them to move around a great deal. Working for any length of time or staying in rooms without windows can have significant adverse effects on people.</i>				

Figure 4.6 An assessment item from the ASPECT
ASPECT = the Staff and Patient Environment Calibration Toolkit

4.8.2 **Data pertaining to patients**

Qualitative and quantitative data were collected to address the patient sub-unit in both case studies (see Figure 4.4). Quantitative data concerning patient competencies were obtained through clinical measures and demographic information. To address research question 1 for Study 3 (see Section 4.3), qualitative data concerning patients’ experience of their behaviour, emotional well-being, and safety in the environment were obtained via field notes and walk-through semi-structured interviews. To address research question 2 (see Section 4.3), quantitative data were obtained via: 1) systematic observation of patient behaviour (behavioural mapping), 2) a selection of self-report measures to assess sleep and emotional well-being (including, depression, anxiety, stress, boredom, and motivation), and 3) an audit of patient falls. The same patients at each case provided data regarding their competencies, experiences, behaviour, and emotional well-being. The eligibility criteria for these participants are described in Section 4.6 above. Figure 4.7 depicts the participation schedule for each of these participants. The data regarding patient safety (audit of patient falls and falls-related injuries) was obtained from a separate set

of patients, as described in Section 4.8.2.5 below. These patients are not described as ‘participants’ in this study.

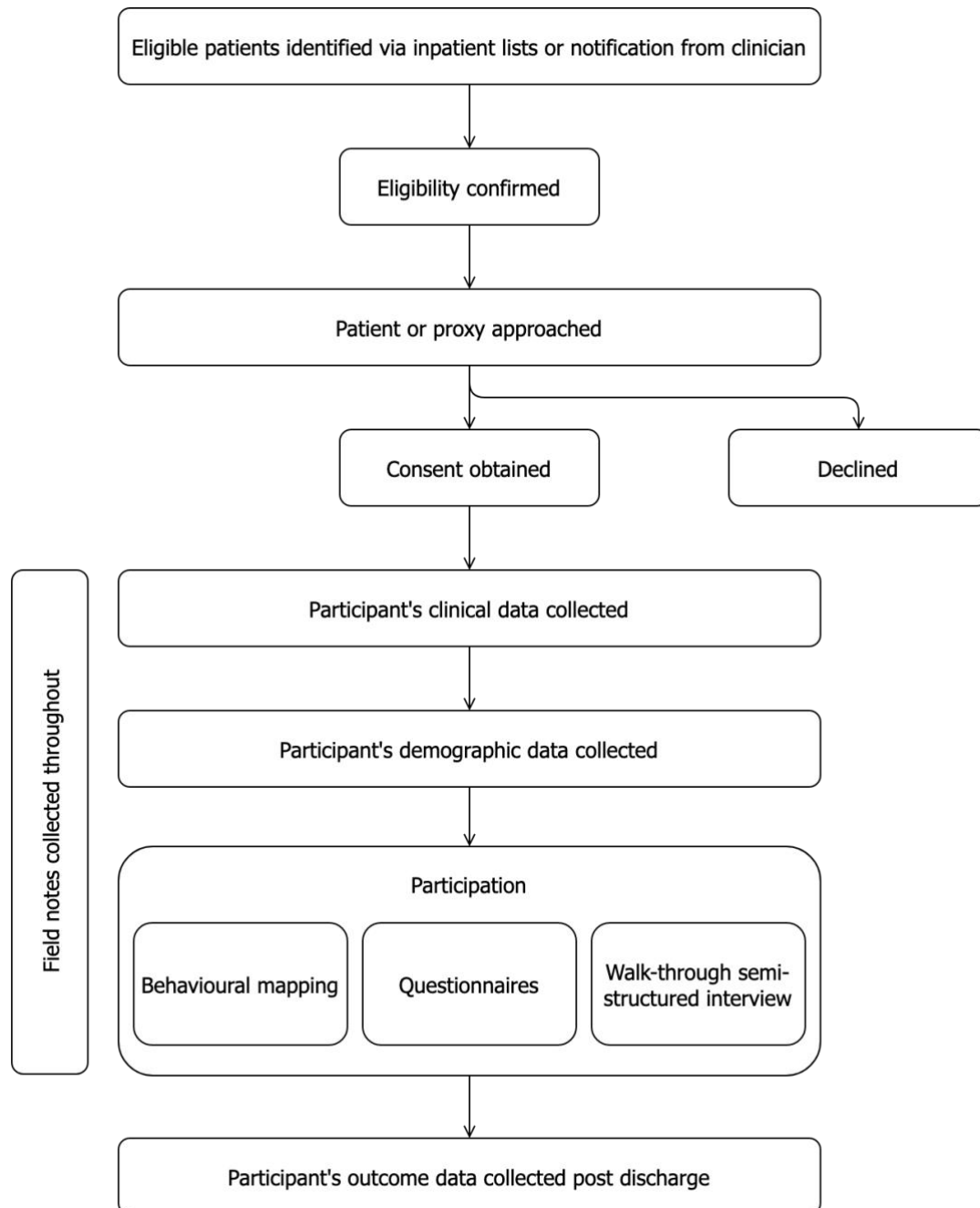


Figure 4.7 Patient participation schedule

Clinical and demographic information were collected, and field notes were kept for all participants. Participants were asked to allow a researcher to observe their behaviour for one day (behavioural mapping), to complete a suite of questionnaires, and to participate in a walk-through semi-structured interview.

4.8.2.1 *Patient competencies: Demographic and clinical reports (quantitative)*

Clinical and demographic data were collected for all participants to describe the participants and their competencies (see Figure 4.4). The demographic data for each participant were collected upon their consent to the study. Participants were asked their age, sex, whether English was their first language, their living and employment situation before being admitted to hospital, education status, and handedness.

Clinical data for each participant were collected upon admission to and discharge from the facility in order to provide a detailed description of the characteristics and competencies of the participants. The clinical data comprised key data recommend for collection by The Stroke Recovery and Rehabilitation Roundtable (Kwakkel et al., 2017), including: date of stroke onset, date of admission to the rehabilitation ward, type and location of stroke, premorbid walking status, comorbidities, premorbid modified Rankin Scale (mRS; van Swieten, Koudstaal, Visser, Schouten, & van Gijn, 1988), Functional Independence Measure (FIM) at admission and discharge (Linacre, Heinemann, Wright, Granger, & Hamilton, 1994), National Institute of Health Stroke Scale (NIHSS) to measure stroke severity (Brott et al., 1989), Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005), date of discharge, and discharge destination.

The NIHSS and MoCA were completed for each participant at, or as close as possible to the time of their participation so that their score reflected their abilities at time of participation. The MoCA could not be administered to participants who were unable to read or write due to physical disability (hemiplegia), visual impairment, moderate-severe aphasia, or lack of fluency in English. The remainder of the CRF data were collected from participants' medical records.

4.8.2.2 *Patient experiences of their behaviour, emotional well-being, and safety in the environment: Field notes and interviews (qualitative)*

Field notes and walk-through semi-structured interviews were used to address research question 1, relating to patients' experience of the environment. In addition to the general field notes collected to describe the physical environment of each case (see Section 4.8.1.1), descriptive and reflective field notes were kept for each participant over the course of their participation in which I reflected on my initial impressions of the interview and the patients' experience, and how these impressions may have been influenced by my personal biases (Sanjek, 1990).

I conducted one-on-one walk-through semi-structured interviews with each participant to provide in-depth qualitative data about patients' experience of the physical environment. Walk-through interviews involve the interviewer moving through the space with the participant, and the participant sharing their observations, thoughts, and experiences as prompted by being in and interacting with the environment. Semi-structured interviews are a common source of data in qualitative studies (Stanley, 2014). Walk-through, "go-along", "roving", or "tour" interviews are accepted methodologies used to explore people's experiences and perspectives of environments, buildings, and spaces (Jones, Bunce, Evans, Gibbs, & Hein, 2008; Kusenbach, 2003; Pink, 2008; Polkinghorne, Given, & Carlson, 2017). Walk-through interviews can elicit rich perspectives about environments that might not be recalled in a "sit-down" interview conducted outside of the setting. Walk-through interviews have been used previously to investigate patients' perspectives of healthcare environments (Hung et al., 2017).

The aim of the field notes was to capture descriptions and reflections on the interaction between the participant and their environment. The field notes included

observations of the participant's behaviour in the environment and their interactions with other people, qualitative information about the impact of their stroke, any pertinent information that the participant relayed outside of their scheduled walk through semi-structured interview, and the route that the participant choose to follow during this interview.

I had prior experience conducting interviews with patient populations, and I piloted the walk-through semi-structured interview prior to commencing data collection by conducting it with the Study 3 consumer advisor, Dennisse Bonnano (DB). DB suggested making the interview schedule more flexible by offering participants the option of drawing or taking photographs to illustrate their thoughts so that they did not have to rely on their verbal expression. DB also suggested allowing participants the option of doing the interview in-situ if they preferred not to mobilise around the ward. If the participant did not wish to move around the facility during the interview, photographs of key spaces in the facility were used to prompt their memory and generate discussion, a technique which has successfully been used by researchers in the past (Margolis & Zunjarwad, 2017; Prosser, 2011).

The interviews were completed at any time during the patients' admission to the ward, except within the first 3 days of admission to allow for some acclimatisation to the environment (see eligibility criteria, Section 4.6). During the interview, participants were encouraged to move through the facility in whichever order or route they chose. All interviews were audio-recorded, and photographs were taken to illustrate specific spaces or features described by participants. Field notes taken during the interview noted the locations visited and any relevant body language or non-verbal information. The interview questions, possible prompts, and preamble are included in Appendix 10.

4.8.2.3 *Patient behaviour: Behavioural mapping and sleep questionnaire* (quantitative)

To address the activity component of research question 2a, behavioural mapping was used to record patients' activity in the environment (see Section 4.3 and Figure 4.4). Behavioural mapping is a systematic and unobtrusive observation technique and has been extensively used in stroke and rehabilitation populations (Bernhardt, Dewey, Thrift, & Donnan, 2004; De Weerd et al., 2000; Mackey et al., 1996; Miller & Keith, 1973). In Study 3, behavioural mapping was based on the AREiSSA protocol, which has been validated for use in stroke rehabilitation settings (Janssen et al., 2014a; Janssen et al., 2014b; Janssen et al., 2012). The behavioural mapping data collection sheet is included in Appendix 11. Prior to completing the behavioural mapping, I received training from researchers experienced in using this data collection method (Julie Bernhardt (JB) and Karen Borschmann).

For each participant, data were collected via behaviour observations made inconspicuously by the researcher at 10-minute intervals over a nine-hour period. Each 10-minute interval is referred to as an 'epoch'. There were therefore 54 epochs in total per participant, including three observer breaks. At each epoch, the researcher observed the participant for up to five seconds and recorded the participant's physical, cognitive, and social activity, their location, and how many people they were with. At each epoch, the participant was presumed to have participated in that activity for the preceding ten minutes. If the participant could not be observed due to observer break or activity precluding direct observation (e.g., participant in the bathroom or behind curtains), an attempt was made to retrospectively estimate their activity by later asking staff or the participant. The data categories in the behavioural mapping data collection sheet can be summarised as follows:

- 1) The location of the participant was recorded at each epoch on the data collection sheet and then coded as described in Section 4.10.2.
- 2) The people present included all other people in the vicinity of the participant who were capable of interacting with the participant. People who were asleep or severely cognitively impaired were not included. People separated from the participant by a physical barrier of some sort (e.g., door or curtain) were not included. People present were categorised as one of the following: doctors, nurses, therapists (allied health); other patients; visitors; or others (e.g., food services, volunteers). The total number of people present was also recorded.
- 3) Physical activity was defined as any purposeful physical movement – e.g., all aspects of mobility, including transfers or ambulation, reaching, sitting unsupported, writing, or participation in activities of daily living such as eating, drinking, or getting dressed.
- 4) Cognitive activity was defined as being engaged in a cognitive task – e.g., reading, writing, playing games such as crosswords, participating in a verbal activity such as reading aloud, speech therapy games, or active listening.
- 5) Social activity was defined as any interaction with another person/s (present or not) – e.g., talking, touch, or non-verbal communication such as laughter.

The Pittsburgh Sleep Quality Index (PSQI) questionnaire was used to address the sleep component of research question 2a (see Section 4.3 and Figure 4.4). The PSQI is used to measure self-reported quality and patterns of sleep (Chronbach's $\alpha = 0.83$, Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI was adapted for Study 3 to refer only to the past week (rather than the past month) in order to correspond more closely with the participant's stay on the rehabilitation ward. The

PSQI was included in a questionnaire booklet, which all participants were asked to complete. Participants could choose to complete this booklet independently or with help from a family member/friend or the researcher. This booklet could be completed at any point in the patient's participation and over as many sessions as they needed. A copy of the booklet (standard version and aphasia-friendly version) is provided in Appendix 9.

4.8.2.4 *Patient emotional well-being: Questionnaires (quantitative)*

In addition to the PSQI, the questionnaire booklet also included questionnaires pertaining to patients' emotional well-being. Questionnaires concerning mood, motivation, and boredom were included to address research question 2b (see Section 4.3 and Figure 4.4). Mood was assessed using the Depression, Anxiety, and Stress Scales (DASS), which measures the emotional states of depression, anxiety, and stress (Lovibond & Lovibond, 1995b). The DASS is validated and has been shown to have clinical relevance in an inpatient setting (Cronbach's $\alpha = .93$, Henry & Crawford, 2005; Ng et al., 2007). The Multidimensional State Boredom Scale (MSBS) was used to measure state boredom (Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013). The MSBS has five subscales, reflecting five recognised dimensions of boredom: 1) disengagement (having nothing to do and not knowing what one wants to do); 2) high arousal (restlessness, agitation, frustration); 3) inattention; 4) low arousal (lethargy, dysphoria); and 5) time perception (time is distorted and moves slowly) (Fahlman et al., 2013). The MSBS has been validated in a large Australian sample (Oxtoby, King, Sheridan, & Obst, 2016), and has also been successfully used in stroke patient populations (Kenah, Bernhardt, Cumming, Spratt, & Janssen, 2018). A visual analogue scale (VAS) designed for this study was

included to assess the extent to which participants think the hospital environment motivates them to participate in rehabilitation practice and activity.

4.8.2.5 *Patient safety: Falls and falls-related injury audit (quantitative)*

To address research question 2c, retrospective records of reported patient falls were obtained for the 12-month period preceding the start of data collection at each case. These falls records were obtained from the relevant Health Information Services, Quality & Safety, or Occupational Health & Safety departments at each case. The falls records included the incident number of each fall that was reported to have occurred on the rehabilitation ward during the 12-month period, the hospital-assigned unique identifying number of the patient involved, whether any injuries resulted from the fall, and a brief description of how and where the fall happened.

The falls records included all patient falls that occurred on the ward, not only those experienced by stroke patients, and patient diagnoses were not provided. In order to identify the stroke patients in the falls records, the falls records were linked to the list of patients discharged from the rehabilitation wards during the same 12-month period using each patient's hospital-assigned unique identifying number. Once the falls records had been linked to the discharge lists, the stroke patients were identified from the discharge lists using the Australian National Subacute and Non-Acute Patient (AN-SNAP) classification system (Green, Gordon, Blanchard, Kobel, & Eagar, 2015). Patients who had been assigned the following AN-SNAP codes upon admission were classified as stroke patients: 4AA1, 4AA2, 4AA3, 4AA4, 4AA5, 4AA6, and 4AA7. Patients assigned AN-SNAP code 4AZ3 or 4AZ4 (indicating 'all other impairments') were also classified as stroke patients if their impairment group was listed as 'stroke'.

4.9 Data management

Data were managed identically for both cases.

4.9.1 *Qualitative data*

All interview audio-recordings were transcribed verbatim with identifying data removed. I completed 50% of the transcriptions (including all of the interviews completed by participants with language or cognitive impairments). The remaining transcriptions were outsourced to a professional service. All transcriptions were checked against the audio recordings during analysis and amended where necessary.

QSR International's NVivo 12 software was used to manage the data and to facilitate analysis (NVivo qualitative data analysis software, 2018). Prior to analysis, all qualitative data (including the audio-recordings, transcriptions, field notes, photographs, and floor plans) were uploaded to NVivo and categorised according to the data type, the case, and the participant where applicable.

4.9.2 *Quantitative data*

The Research Electronic Data Capture (REDCap) platform was used for all quantitative data management, including database build, data storage, data quality assurance, and data export (Harris et al., 2019; Harris et al., 2009). All quantitative data were analysed and visualised using R software for statistical computing (R Core Team, 2017).

4.10 Analysis

The qualitative and quantitative analyses were conducted separately within each case study before being merged, as depicted in Figure 4.3.

4.10.1 ***Qualitative analysis***

The qualitative analysis in Study 3 was conducted using generic qualitative inquiry, which means that qualitative analysis methods were employed without stating an allegiance to any traditional qualitative paradigms (Caelli, Ray, & Mill, 2003; Cooper & Endacott, 2007; Patton, 2015). Patton has proposed that generic qualitative inquiry is particularly suitable for pragmatic, exploratory research (2015). Generic qualitative inquiry is not dissimilar to qualitative descriptive methodology, which is not guided by any traditional qualitative paradigms or theoretical approaches (Colorafi & Evans, 2016; Neergaard, Olesen, Andersen, & Sondergaard, 2009; Sandelowski, 2000; Stanley, 2014). The qualitative data were treated inductively during analysis, allowing the data to speak for itself, but theory and prior knowledge were integrated in the final interpretation of these data. This approach to analysis is referred to as an inductive interpretive approach, as described in Section 1.5.3 (Creswell, 2016).

The qualitative data from each case were initially analysed separately to enable comparison between the cases. The steps involved in the qualitative analysis were as follows:

1. Data prepared for analysis (see Section 4.9.1). This was conducted concurrently for both cases during data collection.
2. All data reviewed in NVivo and initial thoughts recorded using memos (notes) linked to the relevant sections of the data. These memos were a useful first step in categorising and coding the data and were referred to repeatedly throughout analysis. This was conducted for both cases towards the end of data collection.

3. Code the data and develop themes (see Sections 4.10.1.1 and 4.10.1.2). This was conducted for Case 1 first and then for Case 2, with continual reference back and forth between the cases.
4. Validate interpretation (see Section 4.10.1.3). This was conducted concurrently for both cases.

4.10.1.1 *Coding the data*

After preparing and reviewing the data pertaining to both cases, the data were coded in NVivo to generate themes for each case. Themes are distinct categories of information that do not overlap and they constitute the findings in a qualitative study (Creswell, 2016). The process of coding involves identifying and labelling units of information within qualitative text or pictorial data (Creswell, 2016). Similar codes are then combined into larger categories of information, called themes, which are reported in the qualitative results. The codes are therefore the building blocks and evidence for the descriptions and themes in the results. There are many ways in which data can be coded to produce themes (Corbin & Strauss, 2015; Hsieh & Shannon, 2005). To develop a coding system for Study 3, I drew from coding systems described by Blair (2015) and Creswell (2016) and adapted these to fit the inductive interpretive approach. The resulting coding system comprised three levels of coding. The number of codes decreased at each level as the data were subjected to further interpretation and the codes were refined towards themes.

1. **Level 1 coding.** The labels assigned to the data at this first level of coding underwent minimal interpretation from the researcher. This is sometimes referred to as open, or emergent coding and is drawn from Grounded Theory research (Glaser & Strauss, 2017). Specifically, for the text data, level 1

coding involved labelling (i.e., coding) the text using descriptions that were close to the participants' own words. When selecting chunks of data to code, the concept of 'lean coding' was employed with the aim to develop a smaller number of codes overall by concentrating on larger chunks of information in the data (e.g., a paragraph rather than a line of text) (Creswell, 2016).

2. **Level 2 coding.** The 'interpretive' component of the inductive interpretive approach began to be applied at level 2 of the coding system. To create the level 2 codes, the level 1 codes were re-described using some interpretation based on prior knowledge, Person-Environment Fit theory, and/or knowledge of the rest of the data set. Any level 1 codes found to be identical to each other in meaning were combined to reduce the number of level 2 codes.
3. **Level 3 coding.** Related level 2 codes were grouped together into overarching level 3 codes to eliminate redundancy and overlap, and to provide more complete or precise labels. This is referred to as axial coding (Corbin & Strauss, 2015). The level 3 codes formed the beginnings of the themes.
4. **Level 4 coding.** The level 3 codes were used to identify the themes as described in Section 4.10.1.2 below.

Once the level 2 codings were completed for a select number of transcripts from each case, an experienced qualitative researcher (Heidi Zeeman (HZ)) independently completed level 2 coding of the same transcripts to check intercoder agreement (see Section 4.10.1.3 for more detail on intercoder agreement and other reliability measures). After checking intercoder agreement for both cases, the remaining data from Case 1 were coded up to level 3 before analysing the remainder of the Case 2 data.

4.10.1.2 *Identifying themes*

Once the level 3 coding was completed for both cases, a workshop was held with my supervisors and advisors to collectively review the emerging themes (see Section 4.10.1.3 below). Defining the themes for both cases concurrently allowed for reflection back and forth between the cases and observations about similarities and/or differences.

4.10.1.3 *Reliability and validity*

Reliability in qualitative research refers to the extent to which codes are consistent and stable between coders and remain consistent over time (Creswell, 2016). The qualitative research tradition generally acknowledges that each researcher's interpretations may be different and influenced by their preconceptions and prior knowledge (Nicholls, 2009). It is therefore necessary to introduce some measure of reliability to qualitative analysis.

Two approaches were used to ensure reliability: 1) intercoder agreement was checked early in the analysis process and discussion between coders was maintained throughout, and 2) consensus between researchers was sought to generate the final themes. Intercoder agreement involves having two or more researchers independently analyse the same data and then compare their results (Creswell, 2016). To calculate the intercoder agreement, HZ and I independently coded the same two patient interviews from both cases (four interviews in total). Particularly long and descriptively 'rich' interviews were chosen for this. The list of level 2 codes generated independently by me was compared with the list of level 2 codes generated by HZ. Code labels that were developed by both coders and judged by both coders as highly similar were given an agreement score of 1. Code labels that were generated by one coder, but not by the other coder, were said to be in disagreement and were given

a score of 0. Inter-coder agreement was checked for the level 2 codes as these codes involve researcher interpretation, meaning there is a higher risk of inter-coder disagreement at this level compared to level 1. The purpose of this inter-coder agreement process was to establish whether the two researchers were interpreting the contents of the interviews similarly. The simple percentage agreement score between the two coders is included in Section 5.4.1.1, Chapter 5. A statistical measure of agreement (such as Cohen's Kappa) was not calculated for this inter-coder agreement due to the emergent nature of the analysis. To calculate Cohen's Kappa, it is necessary to have a predefined, finite number of units or codes in order to determine the probability of a researcher assigning data to a particular code by chance (Krippendorff, Mathet, Bouvry, & Widlöcher, 2016). We did not have a predefined set of codes prior to analysis and our Level 1 and Level 2 codes continued to emerge as further interviews were analysed. Statistical agreement was therefore not the aim of the inter-coder comparison. Instead, the aim was to achieve consensus agreement between coders in regard to their interpretation of the data and their identification and description of the emergent codes. Any disagreements that emerged during the inter-coder agreement check were therefore discussed until consensus was reached. In addition, researcher consensus was further achieved by holding a workshop to finalise the themes (see 'peer debriefing and review' below).

In contrast to reliability, validity describes the extent to which results are credible representations of reality (Creswell & Miller, 2000). In the context of qualitative research, validity refers to the extent to which the researchers' interpretations of the data are a true representation of the phenomena being studied, and are credible to the participants (Creswell & Miller, 2000). The following three strategies were used in Study 3 to check validity:

1. **Triangulation.** This involves looking for convergence in codes or themes between different types of data, and between participants. Codes or themes that occur in more than one data type or at more than one case have more evidence behind them and so are considered more valid. Many different types of data were collected as part of Study 3 for all participants for both cases (see Figure 4.4). Triangulation was therefore completed between the textual and pictorial data, between participants, and between cases.
2. **Member checking.** This involves sending participants a summary of the findings and asking them whether the findings accurately reflect their experiences. A summary of the qualitative results was sent via email or post in December 2019 to all participants who consented to be contacted. In addition, the consumer advisor on the study (DB) was involved in finalising the results in the peer debriefing and review workshop (see below).
3. **Peer debriefing and review.** In addition to regular meetings between coders, a peer review workshop was held after the analysis had reached level 3 coding. This workshop was attended by HZ, JB, Julie Luker (qualitative analysis expert), DB (consumer advisor), and Sarah-May Blaschke (architect and healthcare environments research expert). The aim of the workshop was to examine the level 3 codes and the data behind them, and to propose level 4 codes in order to develop themes. This workshop helped to ensure both the reliability and validity of the qualitative results.

In addition to these measures, the sampling method used for patients in Study 3 was chosen to keep the patient sample representative and therefore improve the generalisability of results (see Section 4.6 above). All qualitative methods and results have been reported following appropriate checklists for qualitative and case study research (O'Brien et al., 2014; Tong et al., 2007).

4.10.2 **Quantitative analysis**

Descriptive statistics (including counts and percentages; means and standard deviations; or medians and interquartile ranges, as appropriate) were used to summarise recruitment, site characteristics, participant demographic and clinical characteristics, questionnaire responses (including a summary of missing items), and the information in the retrospective falls records. In keeping with the exploratory approach of this study, comparative statistics were not conducted. Instead, the results for each case were compared to population norms where possible using z scores, and data for each case were graphed to visually show relationships between aspects of the physical environment, and patients' competencies, behaviour, and emotional well-being at each case.

For the behavioural mapping data, descriptive statistics (median and interquartile range) were used to report physical activity, cognitive activity, social interaction, the number of people present, and location of all participants and on average for both cases. Each participant's behavioural mapping data were included in the analysis if ≥ 7 hours of observation time was recorded. If the participant could not be observed during a particular epoch, and the data could not be estimated with confidence (see Section 4.8.2.3), then this was reported as missing data.

Counts of each physical activity, cognitive activity, social interaction, number and type of people present, and location category across the behavioural mapping day

were calculated as percentages of the total number of observations per participant. This provided an estimate of the amount of time that a participant spent undertaking each type of activity, or combination of activities, as a proportion of the participant's total observation time. For each epoch, the participant's location was coded as follows:

1. Bedroom: participant's bedroom on the ward.
2. Therapy: therapy areas off ward, e.g., gym, occupational therapy room, therapy kitchen, speech therapy room.
3. Hallways: any hallway including elevators.
4. Bathroom.
5. Communal: designated communal areas inside the hospital (on or off ward), e.g., patient lounge, community room, cafes.
6. Outdoors: outdoor areas on hospital grounds, e.g., therapy garden.
7. Off site: all off-ward locations that are not covered by other categories, e.g., other clinical areas of the hospital for tests/procedures, excursions with occupational therapist, home visits.

4.10.3 ***Cross-case comparison***

As mentioned in Section 4.4.2, cross-case comparison is not a formal methodology, rather it is simply a term used to describe aggregation at the level of the case. In this study, the intention was to compare the two cases throughout data collection and analysis, in order to highlight similarities and differences between the cases, aid in interpretation of the results, and to allow tentative conclusions to be drawn about the transferability of results (see Figure 4.3). During data collection, qualitative observations about the similarities and differences between the cases were recorded in the field notes described in Section 4.8.1.1. These field notes began the

cross-case comparison process and helped to inform the more formal comparisons that were completed throughout analysis. There were six of these more formal cross-case comparisons completed (see below). These more formal cross-case comparisons were completed by placing the findings from Case 1 and Case 2 adjacent to each other in tables and/or figures. The adjacency of the findings helped to highlight the similarities and differences between the cases. The six cross-case comparisons were completed at the following stages of analysis so that the results of each method of data collection were aggregated at the level of the case:

- 1) After the qualitative and quantitative data pertaining to the physical environment (i.e., the fieldnotes, photographs, floor plans, and checklists) had been analysed for each case;
- 2) After the quantitative data pertaining to patient competencies (i.e., the demographic and clinical descriptions of the participants) had been analysed for each case;
- 3) After the qualitative walk-through semi-structured interviews had been analysed and themes obtained and described for each case;
- 4) After the quantitative data pertaining to patient behaviour (i.e., the behavioural mapping and sleep questionnaire) had been analysed for each case;
- 5) After the quantitative data pertaining to patient emotional well-being (i.e., the mood, boredom, and motivation questionnaires) had been analysed for each case;
- 6) After the quantitative data pertaining to patient safety (i.e., the retrospective falls audit) had been analysed for each case.

These cross-case comparisons, the apparent similarities and differences between the cases, and the implications of these similarities and differences were discussed in the peer review workshop (see Section 4.10.1.3). The final interpretations of the cross-case comparisons were summarised in dot points or paragraphs as appropriate and key findings from these cross-case comparisons were incorporated into the convergent mixed methods analysis.

4.10.4 ***Convergent mixed methods analysis***

The qualitative and quantitative results were merged following a convergent mixed methods approach. The merging of these results addressed research question 3: How do stroke patients' experiences of the physical environment of inpatient rehabilitation facilities, and the nature of their behaviour (activity and sleep), emotional well-being, and safety in these spaces, help to explain the role of the physical environment of inpatient rehabilitation facilities in patients' behaviour, emotional well-being, and safety after stroke? To facilitate the merging process, joint display tables were used to make a side-by-side comparison of the qualitative and quantitative data for each of the 'topics' that emerged during analysis (Creswell & Plano Clark, 2018). These topics were drawn from the important aspects of the qualitative themes and the key findings from the quantitative analysis, thus describing evidence from each methodology. The process of identifying these topics began during the peer-review workshop (see Section 4.10.4.1).

Joint display tables place the qualitative and quantitative findings adjacent to each other. This adjacency helps the researcher to compare and convey whether the qualitative and quantitative findings are 'congruent' (agree with each other), 'divergent' (differ from each other), and/or whether they are unique (i.e., only qualitative or only quantitative findings available), thereby allowing the researcher to

gain a more complete understanding of the results (Creswell & Plano Clark, 2018). In this study, four joint display tables were completed, one for each of the constructs in research question 3: 1) activity, 2) sleep, 3) emotional well-being, and 4) safety. Each joint display table was completed for both cases combined, noting the differences between cases. Table 4.1 shows a template of a joint display table. After completing the joint display tables, a narrative integration of the data was completed by weaving the qualitative and quantitative findings together in a written summary of the contents of joint display tables (Fetters et al., 2013).

Table 4.1 A joint display table template.

Qualitative and quantitative findings are compared for each major topic that emerged in the results.

Topics	Qualitative findings	Quantitative findings	Convergence
Topic 1	Qualitative findings 1 • <i>Describe the qualitative findings that relate to this topic.</i>	Quantitative findings 1 • <i>Describe the quantitative findings that relate to this topic.</i> Quantitative findings 2 • <i>Describe the quantitative findings that relate to this topic.</i>	Convergence of findings for topic 1 • <i>Are the qualitative and quantitative findings congruent or divergent (i.e., do they agree with each other)?</i> • <i>Do they expand on each other?</i> • <i>Or are they not available for this topic?</i>
Topic 2	Qualitative findings 2	Quantitative findings 3	Convergence 2
.	.	.	.
.	.	.	.
.	.	.	.
Topic n	Qualitative findings n	Quantitative findings n	Convergence n

4.10.4.1 *Reliability and validity*

Peer review was used to improve the reliability of the mixed methods results. Initial identification of topics and merging of the qualitative and quantitative results began during the peer review workshop (see Section 4.10.4.1). Once the emerging qualitative themes had been identified, the workshop attendees reviewed the preliminary quantitative findings and discussed how these mapped onto the emerging themes. Topics common to the qualitative and quantitative findings were identified during the peer review workshop. These topics were included in the joint display table, which I later populated having been informed by the discussions in the workshop. The joint display table was then reviewed by HZ and JB and any disagreements between researchers were discussed until consensus was reached.

In regard to validity of the mixed-methods results, two approaches were used, both of which are recommended by Creswell and Plano Clarke (2018). Firstly, the qualitative and quantitative research questions mirrored each other (as mentioned in Section 4.4.1), and secondly, the same participants provided both the qualitative and the quantitative data (except the falls audit), which can aid in the merging of the results (Onwuegbuzie & Johnson, 2006).

4.11 **Chapter summary**

The methods outlined in this chapter were used to conduct Study 3 of this thesis: A convergent parallel mixed methods embedded multiple-case study. Drawing on Person-Environment Fit theory and the framework developed in Study 2, Study 3 used mixed methods to explore the role of the physical environment in stroke patients' behaviour, emotional well-being, and safety in two inpatient rehabilitation

facilities. The following three chapters report the results of this multiple-case study. To aid cross-case comparison, the two cases are presented in tandem throughout each chapter and key similarities and differences between the cases are highlighted at the end of each section. Chapters 4 to 7 together constitute a multiple-case report.

In Chapter 5, the physical environment of both cases will be described first (qualitatively, drawing on field notes, and quantitatively, using healthcare design checklists), followed by quantitative description of participants' demographic and clinical characteristics for both cases. The remainder of Chapter 5 will report the qualitative results of the walk-through semi-structured interviews, which were conducted with participants at both cases to understand their experiences of the physical environment and address research question 1. To address research question 2, the quantitative results concerning patients' behaviour, emotional well-being, and safety in the physical environment of each case will be reported in Chapter 6. The qualitative results from each case (reported in Chapter 5) and the quantitative results from each case (reported in Chapter 6) will then be merged using convergent mixed methods in Chapter 7 in order to address research question 3 and better understand the role of the physical environment of inpatient rehabilitation facilities in patients' behaviour, emotional well-being, and safety after stroke.

5 Study 3: Qualitative results of the multiple-case study

5.1 Chapter overview

This chapter is the first of three chapters reporting the results of Study 3. The methods used for Study 3 were described in detail in the previous chapter. The scope of this present chapter is outlined in Figure 5.1 below. First, the qualitative and quantitative results that describe the physical environment sub-unit (external factors) are reported in Section 5.2 for both cases. Next, the recruitment, demographics, and clinical data for participants (internal factors) from each case are provided in Section 5.3. The middle part of this chapter is dedicated to addressing research question 1, regarding how stroke patients experience the physical environment of rehabilitation facilities in the context of their behaviour (activity and sleep), emotional well-being, and safety (see Section 4.3). To address this research question, the qualitative results regarding patients' experience of the physical environment are reported for each case in turn (Section 5.4). Each section of this chapter ends with a comparison between the cases (cross-case comparison). The chapter ends with a discussion of the qualitative results (Section 5.5). All data reported in this chapter were collected between September 2018 and March 2019 at Case 1 (St George's Hospital [SG]), and between November 2018 and June 2019 at Case 2 (Bendigo Hospital [BH]). The photographs and floor plans of the two cases are included in Appendices 12 and 13. The additional materials referred to within this chapter are included in Appendices 14 to 16.

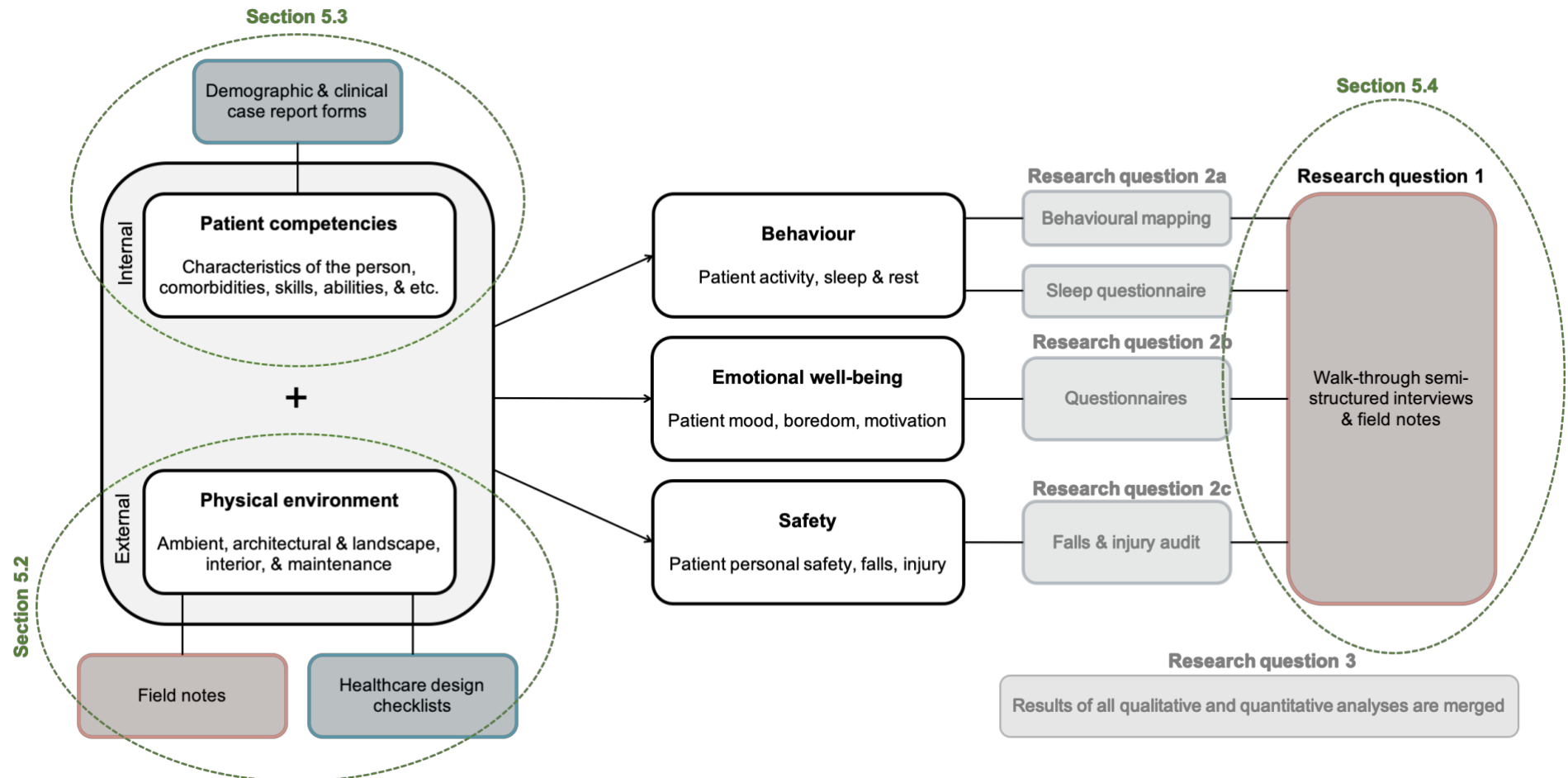


Figure 5.1 The results of Study 3 that are reported in Chapter 5.

This figure is adapted from Figure 4.2, in Chapter 4. Constructs which frame the study are in white, qualitative data collection methods are in pink, quantitative measures are in blue, and mixed methods analysis is in purple. The results pertaining to the physical environment, patient competencies, and research question 1 are reported in Chapter 5 and have been highlighted in the figure. The results addressing research questions 2 and 3 are reported in Chapters 6 and 7 respectively.

5.2 The physical environment of both cases

As outlined in Section 4.8.1, qualitative and quantitative data were collected to describe the physical environment sub-unit of both cases. The intention of these descriptions is to provide context for the remainder of the case study results, and to begin to highlight similarities and differences between the cases. The results of the qualitative data (including field notes, photographs, and floor plans) are presented first for each case (Case 1 [SG] and then Case 2 [BH]), followed by the results of the quantitative data (healthcare design checklists) for each case.

5.2.1 *Field notes, photographs, and floor plans*

The following description of the physical environment of both cases was drawn from field notes, photographs, and floor plans, as described in Section 4.8.1.1. In addition, informal discussions with staff throughout the data collection period helped to inform my understanding of the physical environment.

Case 1, St George's Hospital (SG), is a campus of St Vincent's Hospital in Melbourne, Victoria. The main building houses the rehabilitation ward (first floor), a Geriatric Evaluation and Management (GEM) ward (second floor), outpatient rehabilitation (ground floor), transitional care units (neighbouring buildings), a general medical day service (ground floor), but no emergency or acute medical services. The building is made of a number of different parts, all built at different times. The oldest part was originally a private home (this is not part of the current rehabilitation ward). The home was converted for medical use in 1912 by the Church of England and then became a public healthcare facility in 1949 (Marshall, 1981). It operated as a maternity hospital, then specialised in acute medical and surgical services before focusing on rehabilitation and aged care from the mid-1990s. The

newest part of the current building is the rehabilitation gym (used by inpatients and outpatients), which was built in 2009, designed by Silver Thomas Hanley. Currently, the rehabilitation ward at Case 1 accepts mostly orthopaedic and neurological patients (including stroke). Patients who have had a stroke are admitted to St George's following a stay in an acute stroke ward or acute general medical ward at a different hospital. The layers of history in the building are quite apparent and the design and quality of the environment varies considerably between areas; some of the bedrooms in the rehabilitation ward feel outdated, small, and in need of maintenance, others (which were renovated in the late 1990s) feel larger but not especially modern. There are notices on the walls and a general busyness of colours and objects in the hallways. Some materials and equipment appear in need of upkeep or repair; some paint is chipped, carpet worn, televisions faulty, and the elevators often break down. The facility feels lived-in.

Case 2, Bendigo Hospital (BH) is a publicly funded regional hospital in Bendigo, Victoria. It is a new, large tertiary hospital, servicing a wide region, and includes emergency, acute, all general medical services (e.g., maternity, paediatric, cardiac, oncology, mental health, etc.), as well as rehabilitation. The hospital building opened in 2017 and was designed by Silver Thomas Hanley and Bates Smart. The hospital feels new and quite grand. The main entrance opens into a large, triple-height auditorium, with cafes and indoor trees. Each ward in the building follows approximately the same layout, and there are three wards per floor. The Bendigo Hospital building was built as a Public Private Partnership (PPP) between a private company (Exemplar Health) and the state government (the public Bendigo Hospital). While the public hospital runs all clinical services, Exemplar Health is responsible for managing the building, including maintenance, cleaning, and security. As such, the

staff and patients cannot alter any aspect of the physical environment without permission from Exemplar Health (e.g., nothing can be stuck on the walls). The rehabilitation ward at Case 2 admits neurological rehabilitation patients and GEM patients. Patients who have had a stroke are admitted following a stay in an acute stroke ward or acute general medical ward. The GEM patients generally receive less therapy than the rehabilitation patients and were not included in this study. The whole building, including the ward, feels new and modern, and clean and white.

The bedrooms at Case 1 (SG) were smaller on average than the those at Case 2 (BH) (see floor plans in Appendix 13). The four-bed shared bedrooms were 39m² at Case 1 (SG) and 44m² at Case 2. The single-bed rooms ranged between 11.7m² and 20m² at Case 1 (SG) (the smaller bedrooms were in the older half of the ward), and between 14.3m² and 21m² at Case 2 (BH). In addition, the large windows and relatively high ceilings at Case 2 helped the bedrooms to bigger than they were. The gym at Case 1 (SG), however, was much larger than at Case 2 (BH) (the gym was 313m² at Case 1 and 56m² at Case 2).

Key features of the physical environment of both cases are summarised in a cross-case comparison in Table 5.1, and similarities and differences apparent between the cases are noted (as judged by me, based on observations and field notes). Photographs of both cases are provided in Appendix 12 and floor plans are provided in Appendix 13.

Table 5.1 Comparing in the physical environment of the two cases

	Case 1 (St George's Hospital)	Case 2 (Bendigo Hospital)	Comparison ₁
Remoteness	Metropolitan (Melbourne suburb)	Inner regional (Bendigo, rural town)	Different
Funding	Public	Public	Similar
No. of buildings	Rehabilitation facility is housed in one building. Some additional services (e.g., a transitional care facility) are housed in a separate building.	The majority of rehabilitation services are in the main hospital building, which is on a large campus (see row below). Hydrotherapy and some rehabilitation staff offices are in a separate building on the same campus.	Similar
Local context	On a main street, residential area. Tram stop directly outside building, bus stop on corner. Plentiful paid visitor car park and free on-street parking. Active construction site behind building.	On a hill overlooking town and surrounding countryside. At the intersection of two main roads, bus stop is a short walk. Limited paid visitor car park and some free on-street parking. Hospital campus is large and includes a university campus, cafes, and landscaped outdoor areas.	Different
Type of rehab ward	One rehabilitation ward (orthopaedic and neurological).	One rehabilitation ward (neurological and GEM). There is also a musculoskeletal rehab ward not included in this case study.	Different
No. of beds	31 beds on the rehabilitation ward (but funded for 30).	32 beds on the neurological rehabilitation ward (some of which are dedicated to GEM patients).	Similar
Nurse to patient ratio	1:5 during the day	1:4 during the day	Different
Free-Standing	Free-standing facility, not attached to a tertiary hospital.	Part of a large tertiary hospital which services the region.	Different
Year built	The oldest part of the building was built prior to 1912 (entrance), and the newest in 2009 (rehabilitation gym).	Main hospital building built 2017.	Different

	Case 1 (St George's Hospital)	Case 2 (Bendigo Hospital)	Comparison ₁
Renovations	The building has been renovated multiple times with many extensions added over the years.	None	Different
Purpose-built status	Most of the building (including the ward) was not purpose-built for rehabilitation, but the gym was.	Rehabilitation ward was designed following same template as all other wards, not purpose-built.	Similar
Original purpose	Medical, various	Medical, unspecified	Similar
Floors	Rehabilitation services span two floors (ward on the 1 st floor ward and therapy areas on the ground floor)	Rehabilitation ward and gym are on the 6 th floor, which is the top floor of the building.	Different
Ward layout	Rectangular 'racetrack' with patient's rooms on the outside and staff areas (kitchen, medication storage) inside the rectangle. No dining area; meals eaten in bedrooms.	Triangular 'racetrack' with patient's rooms on the outside and staff areas (kitchen, medication storage, offices, meeting room) inside the triangle. No dining area; meals eaten in bedrooms.	Similar
Ward atmosphere	Hallways feel narrow. Equipment is often stored in hallways or bathrooms. Posters and art in hallways, less colour in bedrooms. Patients bring in personal items, stick things on walls of their bedrooms. No staff area on the ward, except the nurses' station and offices. Patients not allowed off-ward without permission. Busy atmosphere.	Feels big, new, clean, white. Walls are bare, except for some notices and a tree-like freeze along hallway. Hallways are wide, long and light-filled. There is a staff hand-over room, a reception desk, and 2 nurses' stations. Patients not allowed off-ward without permission. Those who are given permission are issued a 'green card'. Ward is busy in some parts, quiet in others.	Different
Therapy areas	Gym, OT kitchen, and OT therapy room are on ground floor. Speech therapy rooms are on the ward (1 st floor). The gym is new and very large with big windows. Therapy garden on ground floor (open access). No hydrotherapy.	Gym and a mixed-use therapy room on same floor as ward. Gym is small. Hydrotherapy and another gym in separate building. No OT kitchen, but 'community room' with a kitchen that patients can use with staff. Therapy garden on floor below (no access without staff). Environmental enrichment station on the ward.	Different

	Case 1 (St George's Hospital)	Case 2 (Bendigo Hospital)	Comparison ¹
Communal areas	Patient lounge ('sunroom') on ward. Sunroom is narrow with windows along one side, a cushioned bench, two chairs, a small table, TV, and books/magazines. Tea making facilities in sunroom, but no water source. Waiting area on the ground floor is occasionally used as a space to sit and talk. Café on ground floor.	Patient lounge and 'lounge nooks' on ward. Patient lounge has central table with chairs, TV, books/magazines, iPads. The lounge nooks each have 2-3 chairs placed near a window at the end of a hallway. Tea making facilities in hallway. Four food outlets/café on lower floors, and another in a separate building.	Different
Outdoor areas	Café outdoor seating and therapy garden on ground floor (next to carpark). Benches out the front of the hospital (next to another car park). Mature native trees at front and sides of building. Balcony off the sunroom is kept locked.	Large, landscaped outdoor areas either side of the hospital on the ground floor. Therapy garden on 4 th floor (no access without staff). Balcony for staff on the same floor as rehab ward (not accessible to patients). Balcony next to gym is kept locked.	Different, but similarly limited and all off-ward
Bedrooms	16 single-bed rooms; 1 three-bed room; 3 four-bed rooms. All have shared bathrooms, except 7 of the single-bed rooms which have ensuite. These 7 single-bed rooms are large, but the ones without ensuite are quite small. One of the single-bed rooms includes kitchenette (but no ensuite).	There are 16 single-bed rooms; 6 two-bed rooms; and 1 four-bed room. All of the single-bed rooms have an ensuite, as do the two-bed rooms. The four-bed room has 2 ensuites. Most bedrooms are large, with high ceilings, and big windows.	Different
% single-bed rooms	52% of the beds are in single-bed rooms.	50% of the beds are in single-bed rooms	Similar
Visiting hrs	8am to 8pm, 7 days per week	3pm-8pm Mon to Fri, 11am-8pm weekends, often not enforced	Similar

OT = Occupational Therapy; rehab = rehabilitation

¹Similarities and differences between the cases were judged by the PhD student researcher (RLS) based on observations and field notes.

5.2.2 *Healthcare building design checklists*

The two checklists described in Section 4.8.1.2 were completed for both cases. Some sections of the checklists required input from staff. The results of the Achieving Excellence Design Evaluation Toolkit (AEDET Evolution) and the Staff and Patient Environment Calibration Toolkit (ASPECT) are summarised in Table 5.2 and Table 5.3 respectively. These results reflect the checklists that were completed at the end of the data collection period for both cases (completed in May 2019 at Case 1 and in June 2019 at Case 2). Items with less than or equal to one score difference between the cases are highlighted in bold.

Table 5.2 Results of the Achieving Excellence Design Evaluation Toolkit at both cases

Item	Case 1 (St George's)	Case 2 (Bendigo)
Character and innovation	2.0	4.8
Form and materials	3.8	5.3
Staff and patient environment	2.7	4.2
Urban and social integration	4.5	5.0
Performance	--	--
Engineering	--	--
Construction	--	--
Use	3.3	4.7
Access	4.4	5.0
Space	3.5	4.7

Items with ≤ 1 score difference between cases are in bold.

Minimum score = 1 (virtually no agreement). Maximum score = 6 (virtually total agreement).

Table 5.3 Results of the Staff and Patient Environment Calibration Toolkit at both cases

Item	Case 1 (St George's)	Case 2 (Bendigo)
Privacy, company, and dignity	3.7	4.8
Views	4.4	5.6
Nature and outdoors	3.3	4.3
Comfort and control	2.8	4.0
Legibility of place	4.2	4.5
Interior appearance	3.4	4.3
Facilities	2.3	3.8
Staff	3.7	5.3

Items with ≤ 1 score difference between cases are in bold.

Minimum score = 1 (virtually no agreement). Maximum score = 6 (virtually total agreement).

The results of the practice versions of the checklists for both cases, which were completed before the start of the data collection period, are reported in Appendix 14. These practice versions were completed seven months earlier than the final checklists reported above.

5.2.3 **Cross-case comparison**

The cases are similar in that they are both publicly funded inpatient rehabilitation facilities with a similar number of beds, and neither were purpose-built for rehabilitation. They have a similar proportion of single-bed rooms, a similar ward layout with no dining room and no outdoor areas accessible from the ward, and both have similar policies concerning visiting hours. The therapy areas are separate from the ward at both cases, and patients at both cases are restricted from visiting off-ward and outdoor areas. In many other respects, the physical environments of the two facilities are quite different. Case 1 (SG) is older, smaller, separate from a tertiary hospital, in a suburb of a large city and connected to public transport, while Case 2 (BH) is new, in a large tertiary regional hospital, and is less connected to public

transport. Case 2 (BH) is a major regional hub for healthcare, whereas Case 1 (SG) is just one of many rehabilitation facilities in metropolitan Melbourne. Case 2 (BH) admits GEM patients to the ward, as well as rehabilitation patients, whereas Case 1 (SG) admits only rehabilitation patients, which may explain the slightly higher nurse to patient ratio at Case 2 (BH). The ward in Case 1 (SG) feels smaller and darker, but more colourful. The ward in Case 2 (BH) feels new, white, and clean. The gym is much larger in Case 1 (SG), and there is access to an Occupational Therapy kitchen. There are different types of bedrooms at both cases, and the bedrooms at Case 2 (BH) feel larger, with big windows and higher ceilings. There is a patient lounge at both cases, but Case 2 (BH) also has lounge nooks in the corridors.

Although the cases received similar scores for some items on the checklists, the newer hospital, Case 2 (BH) scored consistently higher than Case 1 (SG) on all items in both checklists. The category of ‘Character and innovation’ on the AEDET received the biggest difference in scores between the two cases (difference of 2.8). This category deals with the overall feeling of the building and the clarity of design intention. It is perhaps unsurprising that the new building (Case 2) scored higher in this category than the older building (Case 1), as the older building is made up of many different parts and has been renovated a number of times, which has diluted any comprehensive design intention. In this way, Case 1 is likely representative of many of the older rehabilitation facilities in Victoria, as indicated by the findings of Study 2 of this thesis (see Section 2.3).

The category with the next biggest difference in scores between the two cases was the ‘Staff’ category on the ASPECT (difference of 1.6). This category addresses the question of whether staff are well provided for by the building, e.g., whether there are spaces for staff on and off the ward. There were very few staff spaces at Case 1

(SG), whereas at Case 2 (BH) there were two nurses' stations, a communal office, a meeting room, and an off-ward staff room and changing area. The lack of staff offices on the ward at Case 1 (SG) meant that most staff congregated at the nurses' station. This gave a communal atmosphere to the ward but had implications for patient privacy as personal conversations and clinical handovers were carried out in public. Staff at Case 1 (SG) often sat in the patient lounge room or the meeting room on the ward while on their break, while staff at Case 2 (BH) used the off-ward staff lounge.

The categories that received most similar scores between the two cases were 'Urban and social integration', 'Access', 'Nature and outdoors', 'Legibility of place, and 'Interior appearance'. Although the cases scored similarly for these categories, the reasons for their respective scores differed. For example, the 'Access' category addresses the question of access to the vicinity of the building (including public transport and parking), but also addresses the question of routes to get in and out of the building once there (including ramps, lighting, external signage, and emergency access). Case 1 (SG) scored higher on the items regarding public transport and parking, while Case 2 (BH) scored higher on items regarding ramps, lighting, external signage, and emergency access. These scores reflect the location of Case 1 (SG), in a connected metropolitan suburb, and the new, coherent design of Case 2 (BH), with a prominent entrance to the hospital and up-to-date compliance with accessibility standards. In the 'Interior appearance' category, Case 1 (SG) scored higher on items addressing whether patients can display personal items in their own space (because the Public Private Partnership regulations at Case 2 (BH) made this more difficult for patients), whereas Case 2 (BH) scored higher on items addressing whether the interior looks clean, tidy, and cared for (the older interiors at Case 1 were harder to keep looking clean and well-maintained).

The combined information from the field notes, photographs, floor plans, and checklists helps to provide an impression of the physical environment at both cases; the ways in which these cases are similar to each other, and the ways in which they differ. The physical environment of the two cases appears different in a number of ways, and this is reflected in a difference in scores on some of the categories in the healthcare design checklists. However, the overall scores on these checklists are perhaps not all that dissimilar between the cases considering the marked difference in the age and atmosphere of the buildings, their location (metro versus regional), and the fact that one is located within a larger tertiary hospital.

5.3 Participants at both cases

As outlined in Section 4.6, patients at both cases were invited to participate in Study 3. Participants contributed data to the behavioural mapping, questionnaires, and interviews. Twenty patients participated at Case 1(SG) (45% female, mean age = 73 years) and 16 at Case 2 (BH) (37.5% female, mean age = 67.2 years). All clinical and demographic information was collected for all participants, except the MoCA, which was not completed for some participants (see below).

5.3.1 *Approach and consent rates*

Although the intention was to approach all eligible patients (see Section 4.7) this was not always possible. In Case 1 (SG), 79% of the eligible patients who were admitted to the ward during the data collection period were approached for participation (29 eligible, 23 approached). Five of the eligible patients were not approached due to timetabling constraints (i.e., I could not schedule time to approach and collect their data before their expected discharge date) and one was not

approached because the patient's family did not want the patient made aware of their diagnosis. Of the 23 eligible patients who were approached, 87% consented to participate ($n = 20$). Two declined because they were not interested in participating, and one patient with aphasia declined because she was not confident to participate, even with the help of a speech therapist.

In Case 2 (BH), 78% of the eligible patients were approached for participation (27 eligible, 21 approached). All six of the eligible patients who were not approached were missed due to timetabling constraints. Of the 21 patients who were approached, 76% consented to participate ($n = 16$). Three patients declined because they were not interested in participating, one patient with aphasia declined because she was not confident to participate, and one patient declined because his family did not want him to participate. No participants dropped out from either case and none were withdrawn from participation.

5.3.2 ***Demographic profile***

The participants' demographic information is summarised in Table 5.4. Compared to participants in Case 1 (SG), those in Case 2 (BH) appeared to be: younger, a higher proportion of males, had fewer years of education, more likely to have English as a first language, and more likely to be living with others prior to stroke. No statistical comparison was made between the participants at the two cases, as explained in Sections 4.4.2 and 4.10.2.

Table 5.4 Demographics of the participants in each case study

Demographic information	Case 1 (St George's) <i>n</i> = 20	Case 2 (Bendigo) <i>n</i> = 16
Age, mean (range)	73.0 (61-90)	67.2 (43-89)
Sex, <i>n</i> (%)		
Female	9 (45)	6 (37.5)
Male	11 (55)	10 (62.5)
First language is English, <i>n</i> (%)	16 (80)	15 (93.8)
Employment pre-stroke, <i>n</i> (%)		
Full-time	2 (10)	4 (25)
Part-time	3 (15)	1 (6.3)
Not working	15 (75)	11 (68.7)
Education, <i>n</i> (%)		
No education	0	1 (6.3)
Primary school	7 (35)	8 (50)
Secondary school	4 (20)	3 (18.7)
Diploma TAFE or apprentice	4 (20)	4 (25)
Undergraduate university	4 (20)	0 (0)
Postgraduate university	1 (5)	0 (0)
Accommodation pre-stroke, <i>n</i> (%)		
Own home alone	11 (55)	3 (18.7)
Own home with others	9 (45)	12 (75)
Residential aged care	0 (0)	0 (0)
Retirement village	0 (0)	1 (6.3)

5.3.3 ***Clinical profile***

The clinical information for all participants is summarised in Table 5.5. The time since their stroke and the time spent in rehabilitation at the time of participation was similar for participants at both cases. Participants' total length of stay in rehabilitation, and their functional improvement while in rehabilitation (scores on the Functional Independence Measure at discharge compared to score at admission [FIM difference]) were similar for both cases. Participants in Case 2 (BH) appeared to

suffer more extensive impairment as a result of stroke (higher scores on the National Institute of Health Stroke Scale [NIHSS] and have more functional dependency (lower scores on the FIM) than participants in Case 1 (SG). More participants in Case 2 appeared to experience communication impairments (aphasia or dysarthria) and more participants appeared to be dependent on others for all mobility, compared to Case 1.

Table 5.5 Clinical information of the participants in each case study

Clinical information	Case 1 (St George's) <i>n</i> = 20	Case 2 (Bendigo) <i>n</i> = 16
Days since stroke, mean (<i>SD</i> , range)	36.2 (25.5, 9-116)	34.3 (27.7, 5-114)
Days in rehab at participation, mean (<i>SD</i> , range)	18.2 (14.3, 4-66)	19.6 (17.8, 3-66)
First stroke, <i>n</i> (%)	13 (65)	10 (62.5)
Stroke type, <i>n</i> (%)		
Ischaemic	15 (75)	13 (81.3)
Haemorrhagic	5 (25)	3 (18.7)
Pre-stroke walking, <i>n</i> (%)		
Walking independently no aids	16 (80)	14 (87.5)
Walking with gait aid	4 (20)	2 (12.5)
No. of comorbidities, <i>n</i> (%)		
None	4 (20)	5 (31.3)
One	12 (60)	10 (62.5)
Two	3 (15)	1 (6.3)
Three	1 (5)	0 (0)
Type of comorbidity, <i>n</i> (%) ₁		
Cognitive decline	2 (10)	1 (6.3)
Osteoarthritis	6 (30)	0 (0)
Other	13 (65)	11 (68.7)
Pre-stroke mRS, <i>n</i> (%)		
No symptoms	7 (35)	5 (31.3)
No dis. despite symptoms	11 (55)	7 (43.7)
Slight disability	2 (10)	1 (6.3)
Moderate disability	0 (0)	3 (18.7)
Moderately severe disability	0 (0)	0 (0)
Severe disability	0 (0)	0 (0)
Stroke severity, NIHSS, median (IQR)	5 (6)	7 (5.5)
Minor (1-4), <i>n</i> (%)	9 (45)	4 (25)
Moderate (5-15), <i>n</i> (%)	11 (55)	11 (68.7)
Moderate to severe (16-20), <i>n</i> (%)	0 (0)	1 (6.3)
Severe (21-42), <i>n</i> (%)	0 (0)	0 (0)
Aphasia or dysarthria, <i>n</i> (%) ₂	7 (35)	7 (43.7)

Clinical information	Case 1 (St George's) <i>n</i> = 20	Case 2 (Bendigo) <i>n</i> = 16
MoCA, median (IQR) ³	21.5 (4.5)	19 (6)
Normal, MoCA ≥ 26 , <i>n</i> (%)	4 (20)	1 (6.3)
Mild, MoCA 18-25, <i>n</i> (%)	13 (65)	7 (43.7)
Moderate, MoCA 10-17, <i>n</i> (%)	1 (5)	5 (31.3)
Severe, MoCA < 10 , <i>n</i> (%)	2 (10)	0 (0)
Unknown, MoCA incomplete	0 (0)	3 (18.7)
Mobility at participation, <i>n</i> (%) ⁴		
Independently mobile	12 (60)	7 (43.7)
Dependent for mobilisation	8 (40)	9 (56.3)
FIM admission, mean (<i>SD</i> , range)	66.8 (25, 23-101)	53.1 (19.7, 23-84)
FIM discharge, mean (<i>SD</i> , range)	95 (27.0, 48-126)	80.6 (26.6, 27-117)
FIM difference, mean (<i>SD</i> , range)	28.2 (15.2, 2-60)	27.5 (15.3, 3-56)
Length of stay in rehab in days, mean (<i>SD</i> , range)	42.2 (27.9, 8-108)	45.6 (30.5, 14-127)
Discharge destination, <i>n</i> (%)		
House or flat - alone	3 (15)	1 (6.3)
House or flat - with others	10 (50)	5 (31.3)
Residential aged care	2 (10)	0 (0)
Retirement village	1 (5)	0 (0)
Transition care planning	1 (5)	5 (31.3)
Other hospital ward	3 (15)	5 (31.3)

Acronyms: FIM = Functional Independence Measure, mRS = modified Rankin Score, NIHSS = National Institute of Health Stroke Scale, MoCA = Montreal cognitive assessment, *SD* = standard deviation.

¹The *n* is larger than the total number of participants with comorbidities because some participants had more than one comorbidity.

²The presence of aphasia and dysarthria determined by the NIHSS. Scores of 1, 2, or 3 on question 9 of the NIHSS indicate aphasia. Scores of 1 or 2 on question 10 of the NIHSS indicate dysarthria.

³The MoCA was not completed by 3 participants at Bendigo. The severity levels are recommended by MoCA but have not yet been established by research.

⁴Patients who could mobilise independently without aids or using a walking frame or self-propelled wheelchair without the help of another person are classified as independently mobile. Patients who require another person to assist with their locomotion are classified as dependent for mobilisation.

Due to the limitations of completing the cognitive screen (Montreal cognitive assessment [MoCA]) with people who have language or vision impairment/s or who are not fluent in English (see Section 4.8.2.1), the MoCA was not completed with three participants at Case 2 (BH): one had moderate-severe aphasia (score of 2 on NIHSS question 9, ‘best language’); one was not sufficiently fluent in English and had dysarthria (MoCA was attempted with a speech pathologist but was untenable); and one had pervasive loss of vision (score of 2 on NIHSS question 3, ‘visual’, indicating complete hemianopia). The participant with pervasive loss of vision did show indications of severe cognitive decline. This participant was the only patient consented via proxy and scored 2 on NIHSS question 1b, ‘Locus of Control - Questions’, meaning that he could not recall his age or the current month. Although the mean MoCA score was similar in both cases, the number of participants in each band of cognitive impairment was quite different between cases, with a greater proportion of participants in Case 1 (SG) exhibiting ‘normal’ cognition or ‘mild’ cognitive impairment compared to Case 2 (BH).

Patient competency is central to Person-Environment Fit theory and is an important construct in Study 3 (see Section 4.2 and Figure 4.2). The concept of patient competency is complex; there are many aspects of a person’s characteristics that may influence their behaviour, emotional well-being, and safety after stroke (see Section 1.2). At a simplified level, patients’ competencies after stroke may be impacted by Mobility, Language, and/or Cognitive impairments. These categories of impairments are referred to in the remainder of this thesis to describe the experiences, behaviours, and emotional well-being of participants with different types of impairments. Participants with aphasia and/or dysarthria on the NIHSS were classified as having Language impairments (see Table 5.5, superscript 2). Participants

who scored ≤ 17 on the MoCA were classified as having Cognitive impairments. Participants who did not complete the MoCA were classified as having cognitive impairments if they scored 2 on NIHSS question 1b, i.e., they could not recall their age and the current month upon questioning. Participants who were dependent for locomotion were classified as having Mobility impairments (see Table 5.5, superscript 4).

At Case 1, 40% of participants had a Language and/or Cognitive impairment ($n = 8$), 40% had a Mobility impairment ($n = 8$), and 10% had all three impairment types ($n = 2$). At Case 2, 75% of participants had a Language and/or Cognitive impairment ($n = 12$), 56% had a Mobility impairment ($n = 9$), and 6.3% had all three impairment types ($n = 1$). Participants' demographics, clinical characteristics, and competencies (i.e., Mobility, Language, and/or Cognitive impairments) will be integrated into the reporting and interpretation of results in the remainder of this chapter, and in Chapters 6 and 7.

5.3.4 **Bedroom type**

Although there was a similar proportion of single-bed rooms in both cases (see Table 5.1), a little over a third of the participants at Case 2 (BH) were in a single bedroom, whereas two thirds of the participants were in a single-bed room at Case 1 (SG) (see Table 5.6). The type of bedroom that participants were in will be integrated into the reporting and interpretation of results in the remainder of this chapter, and in Chapters 6 and 7.

Table 5.6 Participants' bedroom type in each case study

Room type ¹ , <i>n</i> (%)	Case 1 (St George's)	Case 2 (Bendigo)
	<i>n</i> = 20	<i>n</i> = 16
Single-bed room, any type	13 (65)	6 (37.5)
Single, ensuite	9 (45)	6 (37.5)
Single, shared bathroom	1 (5)	0 (0)
Single, kitchen, shared bathroom	3 (15)	0 (0)
Shared bedroom, any type	7 (35)	10 (62.5)
Two-bed room	0 (0)	7 (43.7)
Three-bed room	4 (20)	0 (0)
Four-bed room	3 (15)	3 (18.8)

¹Room type was recorded during participation in the behavioural mapping. One participant in Case 1 changed rooms after behavioural mapping and before the interview from a four-bed room to a single-bed room with kitchen and shared bathroom.

Participants with language and/or cognitive impairments were more likely to be in a single bedroom at both cases (75% of participants with these impairments were allocated a single bedroom at Case 1 [*n* = 6] compared to 58% of participants without impairments [*n* = 7]; 42% of participants with impairments were allocated a single bedroom at Case 2 [*n* = 5] compared to 25% of participants without impairments [*n* = 1]).

5.3.5 **Cross-case comparison**

The clinical and demographic differences between the participants at the two cases is not unexpected since the patient profile is different at regional hospitals compared to metropolitan hospitals (Stroke Foundation, 2017). Participants at Case 2 were more unwell than participants at Case 1, which may reflect the fact that Case 2 is a tertiary hospital, servicing a large geographic region, whereas Case 1 is just one facility among many in metropolitan Melbourne.

Participants at Case 2 were more likely to be in a shared room than participants at Case 1, despite the proportion of single-bed rooms being the same at both cases. The single-bed rooms at both cases were described by the Nurse Unit Manager as being allocated on the basis of patient need, where each patient's need for a single-bed room was assessed relative to every other current patient's need. This raises the question of why patients with language and/or cognitive impairments were more likely to be assigned a single-bed room – were they considered to be more of need of a private room? And if so, why? The rehabilitation ward at Case 1 was shared with GEM patients (see Section 5.2.1), who were considered by the staff to be generally more frail than the rehabilitation patients. This may have meant that the relative need of stroke patients for a single-bed room was different between the cases, which may account for a difference in room allocation.

5.4 Patients' experiences at both cases: Field notes and interviews

Walk-through semi-structured interviews were completed with participants at both cases to better understand their experiences of the physical environment in the context of their behaviour (activity, sleep and rest), their emotional well-being, and their safety (research question 1, see Figure 5.1). All participants in both cases completed an interview. The duration of the interviews varied between 10 and 82 minutes in Case 1 (SG) (average of 47 minutes), and between 12 and 58 minutes in Case 2 (BH) (average of 30 minutes). The interviews were analysed in conjunction with the field notes as described in Section 4.10.1. A number of measures were taken

to improve the reliability and validity of the qualitative analysis (see Section 4.10.1.3 and results shown in Section 5.4.1).

Once all reliability and validity measures were completed, qualitative analysis revealed four themes common to both cases: 1) Entrapment and escape; 2) Power, dependency, and identity in an institutional environment; 3) The rehabilitation facility is a shared space; and 4) The environment should be legible and patient-centred. The relationships and overlaps between themes are noted below, painting a complex picture of participants' experiences of the physical environment of inpatient rehabilitation facilities. In the majority of cases, each participant shared comments that addressed each of the 4 themes. These themes, and their sub-themes, emerged from both cases, but some aspects of the themes manifested differently in each of the cases. These themes are described in more detail below, first as they manifested in Case 1 (SG) and then in Case 2 (BH). Illustrative quotes are included throughout and a table of additional quotes relevant to each theme is included in Appendix 15.

5.4.1 *Reliability and validity*

Intercoder comparison, participant checking, and peer debriefing and review were used to improve the reliability and validity of the qualitative analysis, as outlined in Section 4.10.1.3.

5.4.1.1 *Intercoder comparison*

Eleven per cent of the interview transcripts (2 transcripts from each case) were double coded by HZ up to level 2 coding to investigate whether the contents of the interviews were interpreted similarly by two researchers (as described in Section 4.10.1.3). The average percent agreement between the two coders was 70.4%. That is, 70.4% of the total number of level 2 codes generated by the two coders were judged

to be similar to each other in meaning. The coders then discussed any disagreements until consensus was reached and the agreed codes were included in the analysis. I independently coded the remainder of the transcripts and all level 3 and level 4 codes were reviewed in the peer debriefing workshop (see below).

5.4.1.2 Summary of results sent to participants

A summary of the qualitative interview results was sent to participants in December 2019 inviting their feedback, as described in Section 4.10.1.3. All participants at Case 1 (SG, $n = 20$) and 56% of participants at Case 2 (BH, $n = 9$) had consented to be contacted after participation and were sent the summary. A copy of the summary is contained in Appendix 16. One participant from Case 1 replied, voiced her approval, and requested no changes. To date, no other participants have provided feedback.

5.4.1.3 Peer debriefing and review

Consensus between researchers (reliability) and the peer debriefing and review (validity) were addressed via a half-day peer review workshop held in September 2019. The workshop attendees are listed in Section 4.10.1.3. Prior to the workshop, attendees were provided with a summary of the qualitative coding to date and preliminary themes. The preliminary themes were reviewed during the workshop, some were re-organised or re-worded, and some were merged following group consensus. For example, two of the preliminary themes ('Dependency' and 'Institutional environment – power and identity') were combined to create Theme 2, and two other preliminary themes ('Orientation in the physical environment' and 'Efficiency and function') were combined to create Theme 4. The workshop attendees then reviewed the preliminary quantitative findings and discussed these in light of the

qualitative themes, thus beginning the convergent mixed methods analysis process (see Chapter 7).

5.4.2 **Themes in Case 1 (St George's)**

5.4.2.1 *Theme 1: Entrapment and escape*

Participants felt trapped by their illness or disabilities, but this was not the sole reason for their feelings of entrapment. Theme 1 consists of three subthemes: 1.1) The environment is restrictive and boring; 1.2) Connection, purpose, and change are means of escape; and 1.3) Nature and the outdoors are means of escape. Sub-themes are shown in bold below as results are presented in more detail. Illustrative quotes are included throughout. Additional quotes can be found in Figure 5.2 below and in Appendix 15.

The environment of the ward, and especially the bedrooms, felt “*closed in*” (2656-13), **restrictive, and boring (sub-theme 1.1)**. Some participants felt trapped in time, as well as space, and felt that the hospital was somehow separate from the real world (see also Theme 2 ‘Institutional environment’). The repetition of day-to-day activities combined with an extended and an uncertain length of stay created an experience for participants that was foreign and out of their control – “[T]ime warps to you when you’re in this situation. You’re never in charge of time, but it warps.” (2656-01). Some found this monotonous and described feeling “*bored witless*” (2656-02). Others felt that time passed quickly as their days were packed with activities, but that they had little control over their time and “*not much time left to think*” (2656-05). Clocks, timetables, and natural light from windows in bedrooms helped participants to keep track of the passing of time, although there were shortcomings in terms of where these were placed in the room (see Theme 4).

Spending too long in one room or too much time alone contributed to this feeling – “[My bedroom] stinks ... because I’m sitting here all day ... It’s not good for the brain. It’s not good for you. You’re talking to nobody. ... I don’t like anything in the room because it’s still locking you up.” (2656-08). In addition to feeling trapped in their bedroom, some of the participants who had mobility impairments were physically restrained by bed alarms, a technology designed to reduce falls. These sounded an alarm when participants moved in bed, interrupted their sleep, and caused them great frustration.

The sense of entrapment motivated some participants towards recovery, generally those without significant impairments – “everybody ... here there’d be only one thought in their head: just to ... get better and get out” (2656-08) – but it prompted other participants who were independent for mobility to seek-out stimuli, sometimes at possible risk to their own safety, and breaching hospital policy. One participant with language impairment as their main impairment after stroke entertained himself by sitting in the hallway, watching the security door and attempting to decipher the pin code as staff exited. Other participants, with all types and combinations of impairments, responded with resignation, diminished initiative, and inactivity – “I’m just passing the time in here waiting to get out” (2656-19). Sub-theme 2.3 ‘Ownership of the environment’ provides further discussion of participants’ varied levels of engagement with their surroundings.

Connection to other people and to the outside world, variety and change in the environment, and purposeful activities (sub-theme 1.2) all helped to mitigate the sense of restriction and boredom. Visitors were an important source of escape and social interaction (see Theme 3 ‘Shared space’). Participants were aware that the facility’s physical connection to the outside world (e.g., public transport,

parking, cafes, etc.) may impact their visitors, and some participants took this into account when choosing a facility – “*Well that is the reason why [I came to this hospital instead of the one in the city], I thought well all my kids and whatever they’ve all got cars there’s station its easier for them to get here ... It’s a hell of a lot easier to get a parking spot*” (2656-04). Seeing people in the corridor and views of urban life through windows helped participants to feel tethered to “*the world going about its business*” (2656-16). Changes outside a window, such as progress on a construction site or a tree coming into leaf, introduced welcome variety, distraction, and a sense of progress in what was otherwise a relatively static existence. The large size of the gym, and its many windows particularly with views to the outdoors, helped participants to feel less trapped: “*There’s good views from [the gym] ... being able to see off into the distance is wonderful. ... another world. Magic. ... Yeah it’s freedom, like when you’re locked in a [bed]room all the time it’s lovely to see the distance and the hills ... it’s the freedom of the big wide open space*” (2656-10). Meaningful and purposeful objects, such as therapy equipment and mobility aids, provided physical markers of recovery throughout the building; participants could work towards using a new piece of gym equipment or feel pride over a wheelchair license certificate on their bedroom wall.

Connection to nature and the outdoors (sub-theme 1.3) was another important form of escape – “*It is much better than sitting in that dark [bed]room. ... The fresh air. The green grass. ... The open air that’s what I like. Freedom*” (2656-08). While sitting in the therapy garden, participants spoke about the sensory experience of nature: bird sounds, the smell of leaves, fresh air. These benefits could be experienced by bringing nature into the building (e.g., pot plants). Outdoor areas

could be improved by having more plants (see quote 1.3.8 in Appendix 15). Access to sunlight was especially important, both inside and outside the building.

Just being outdoors, whether the outdoor environment was urban or nature-based, was a means of escape. It marked an important step towards discharge, and helped participants feel orientated to their surroundings. Views of the outdoors through windows did not need to be nature-based to provide an escape, but any natural elements were noticed and valued. Trips outside the hospital building (e.g., home visits, sitting in garden with visitors, practicing walking on a footpath, or using public transport with a therapist) were appreciated. Therapy activities that took participants outside the restrictive environment of the hospital building were seen as more purposeful and beneficial to recovery than localised indoor activities, such as walking in a loop around the ward. Participants with all variety of impairments appreciated any opportunity to leave the ward (e.g., therapy sessions in the gym), even if they did not involve going outdoors – *“I suppose in a small way, [the gym] represents my outside world”* (2656-03). Contact with the outdoors was dependant on hospital policy (see sub-theme 2.1), building accessibility (e.g., wheelchair access), and weather. Although one participant wanted to go out of the hospital, she felt frightened by the prospect and confronted by her language and cognitive impairments that had previously been cushioned by the ward environment (2656-18). Balconies were suggested as a way to connect to the outdoors without leaving the ward; unfortunately, the existing balcony at Case 1 (mentioned in Table 5.1) was kept locked due to safety concerns (see sub-theme 4.2).

In summary, these findings suggest that stroke patients experience the rehabilitation ward environment as restrictive, static, and boring. The physical environment could help to alleviate patients’ sense of entrapment by introducing

variety and change, connection with other people, and access to nature and the outdoors. Opportunities to leave the hospital environment may be the most effective way to satisfy all of these conditions and help people to feel a sense of escape.

5.4.2.2 *Theme 2: Power, dependency, and identity in an institutional environment*

Participants experienced the rehabilitation facility as an institutional environment, in which staff, policies, and procedures had power over participants' movements and activities, akin to being "*in a prison*" (2656-11) or "*in school*" (2656-12). This theme consisted of three sub-themes: 2.1) Surveillance; 2.2) Relying on the environment for safety and well-being; and 2.3) Ownership of the environment. Although the facility's social environment and safety policies (described in Section 5.2) likely contributed to participants' experience of being in an institution, this theme focuses specifically on how the *physical environment* reinforced this experience.

Participants' perception of being under **surveillance** contributed to their sense of being in an institution (**sub-theme 2.1**), prompting at least one participant to propose self-discharge and another to routinely sneak out of the hospital – "[I] *sneak out. ... [I] just sit down there in the sun ... [I go outside to] just get out of all this, you know. There's too much watching. ... [going outside is] a release. Nobody around to tell you what to do*" (2656-12). As well as being restrictive, the bed alarms (described in sub-theme 1.1) were also a form of surveillance, reacting to every movement. Although surveillance was an issue, most participants recognised their dependency on others and so did not want to be left entirely alone. This balance between wanting privacy but not wanting to be alone is discussed further in Theme 3 'Shared space'.

Participants **relied on the physical environment for their safety and well-being (sub-theme 2.2)**. Aspects of the physical environment, such as the nurse call-bell, facilitated connection with staff and were an important safety net for participants – *“if I don’t [feel safe then] I know this [call-bell] is here. ... without that I feel I’m cut off”* (2656-17). Unfortunately, the call-bell was not entirely reliable. It could easily be dropped or misplaced, and it was difficult for participants to determine whether it had been activated correctly. One participant who was dependent for mobility responded to this unreliability by requesting that staff check on her every 30 minutes during the night (see quote 2.2.47 in Appendix 15). Another participant, also dependent for mobility, responded by pulling out cords next to his bed to sound the emergency alarm when he did not get a response by pressing the nurse call-bell (2656-16).

Newspapers and technologies such as televisions, smartphones, and tablets facilitated entertainment and communication with loved ones. However, the televisions did not always work, and participants’ personal devices were dependent on unreliable hospital infrastructure: internet connections were unstable and power points were not within reach. See sub-theme 4.2 ‘Convenience and suitability’ for further discussion of how the physical environment could be perceived as unreliable by patients.

Other people in the environment were very important for participants’ emotional well-being (see Theme 3 ‘Shared space’), but visual and aural aesthetics also played a role. Plants, artwork, and views were all mentioned as beneficial for well-being (for examples see Theme 1 ‘Entrapment and escape’). The colour of the ward felt boring and institutional, and inequalities were noticed between staff areas and patient areas, with the staff areas appearing more lived-in and aesthetically

pleasing – *“Beige. The whole place is beige. ... It just flattens you. ... There’s nothing out there to amuse you it’s just all beige ... you go down to the reception area you got plants and cards and that to brighten it. But we got beige”* (2656-01). Participants felt that the physical environment offered them no reason to leave their bedroom – *“there’s nothing interesting out there”* (2656-09).

There were a number of other features in the physical environment which indicated to participants that the ward belonged to the staff, rather than to the participants. Access to certain areas was controlled via physical barriers (e.g., locked doors) and, occasionally, misleading signage (e.g., a false ‘out of order’ sign on the lift to discourage a participant described as a “wanderer”). Computers in the hallway were for the use of staff, not patients. One participant assumed that the ward balcony, which was locked because it was deemed a falls risk, was being reserved for the enjoyment of staff, and another assumed that the reason he did not know about the lounge room was because *“the staff are keeping [it] to themselves maybe”* (2656-10).

The sub-theme of **ownership of the environment (2.3)** encapsulated whether participants felt they belonged in the space (identity, personalising the space), whether they felt the space belonged to them (control, freedom of movement), and the extent to which they felt engaged and invested in the space (which was also mentioned briefly in Theme 1). When viewed as a space that did not belong to them, participants could dismiss the rehabilitation environment as a temporary aberration that they had to put up with until they went home – an attitude that was related to inactivity for some participants (see sub-theme 1.2). Low expectations or nihilism led participants to accept the environment as good enough, or unlikely to change. Other participants expected and wanted the space to be better, and provided many suggestions for

improvement (see sub-theme 4.2), indicating that they felt some personal investment in the space.

Unless explicitly told otherwise, most participants assumed that there were rules to restrict their freedom of movement and believed they needed permission to leave their bedroom. Many participants felt that the restrictions placed on them were gratuitous, did not match their level of ability, or that the reasons for the restrictions had not been properly explained (see quotes 2.1.15 and 2.1.24 in Appendix 15). Some participants chose to restrict their own movements because they worried that leaving their bedroom would inconvenience or annoy staff – *“it’ll be OT soon [so] I’m sitting [in my bedroom] waiting for them cos I don’t want people to wait for me”* (2656-09). Restricted movement resulted in limited knowledge of the environment and may have therefore impacted participants’ sense of ownership (discussed further in sub-theme 4.1). On the other hand, some independently mobile participants were less inhibited and felt free to leave their bedroom, whether they were given permission or not. One participant took the liberty of arranging an empty meeting room to suit his needs by re-positioning the chairs so that he could sit looking out the window to observe people on the street – *“if you turn that way it’s better because that way I can see oh there are tr oh cars there they can see people are walking they can see bicycles ... things are to me are like interest are observance observance to just things that anything happening”* (2656-11, participant with aphasia). Regardless, there were many aspects of the environment which participants could not control (e.g., food, noise, and temperature, some of which is discussed in sub-theme 4.2) or which did not reflect their values or preferences. It seemed that food was routinely personalised to meet medical requirements (e.g., texture for swallowing), but not personalised to meet

personal preferences. Participants also noted the waste produced by disposable cups and uneaten food as something they would change, if they could.

Staff and visitors generally encouraged and assisted participants to personalise their bedrooms. Pictures could be taped to the bedroom walls and there were shelves to place personal belongings (but surfaces were limited, see sub-theme 4.2). Personal photographs were a conversation starter, leading to more meaningful social interactions between participants and staff. The bedroom became a temporary home for some, but this was tempered by the memory of their real home, where they would prefer to be – *“where they put your change of clothes that’s where you classify as your home... but ... sometimes it is a bit of a hard pill to swallow”* (2656-04). Sharing a bedroom with other participants made it harder to personalise the space. Participants were careful not to impact their roommates – *“Not enough room to put stuff up. ... We have to respect other people, is another thing, because if I put something on and doesn’t suit the other person I don’t want to disturb her”* (2656-05). Some participants used headphones to personalise their aural environment without disturbing others. See sub-theme 3.1 for further discussion of shared bedrooms. Like the bedrooms, the gym and therapy areas could also incite a sense of ownership. The gym was obviously designed for participants and contained equipment that was meaningful and useful for them – *“Everything’s perfect [in the gym] for what I’ve gotta do”* (2657-08).

Although staff encouraged visitors, there were aspects of the physical environment, which made it difficult for participants to be hospitable; a frustrating reminder of their lack of control over the space – *“those people have come to see me and if I can’t accommodate them to a point where they’re comfortable ... then it defeats the purpose of the exercise of the visit”* (2656-13). Space was limited in some

of the bedrooms (especially the shared bedrooms), chairs were in short supply, and the tea and coffee station was sub-optimal (see sub-theme 4.1). The ward lounge also was not ideal for hosting visitors (see sub-theme 3.3); although it was perhaps more accommodating than a shared bedroom. Interestingly, one participant took advantage of the shared bedroom being unaccommodating and chose to see visitors there instead of the lounge if she wanted their visit to be short, thereby using the environment to take control (2656-05).

In summary, as one participant clarified, *“I don’t think [participants] in here want power. They want respect. There’s a big difference”* 2656-01. It appears that the institutional atmosphere was exacerbated by perceived surveillance, and that this atmosphere could perhaps be attenuated by encouraging patients to feel that they have rights as residents in the space, promoting their sense of ownership, and allowing reasonable freedom of movement.

5.4.2.3 *Theme 3: The rehabilitation facility is a shared space*

The rehabilitation facility is a shared space where many different people – staff, participants, visitors – need to coexist. Navigating this complex social environment can be challenging, especially for participants as they enter this new social hierarchy without preparation, and reside there for 24 hours a day for weeks or months. Participants’ experience of a space was partly determined by the people who they shared the space with and how these people behaved. This theme describes features of the *physical* environment that modulated this social environment. This theme focuses on four key spaces: bedrooms, hallways, therapy spaces, and designated communal spaces (e.g., ward lounge). This theme had three sub-themes: 3.1) Compromise, privacy, and peer support in the bedrooms; 3.2) Social connection in hallways and therapy spaces; and 3.3) Seeking defined communal spaces.

Living in a shared space involved noticing other peoples' differing standards and needs. The **bedrooms** in particular were a site of **compromise (sub-theme 3.1)**. Participants in shared bedrooms adjusted their behaviour to accommodate their roommates (see sub-theme 2.3). Participants in single-bed rooms were also impacted by other people, especially in the use of bathroom facilities as some of the single-bed rooms at Case 1 (SG) did not have an ensuite (see Section 5.2) – *"I hate having a shared bathroom. ... like in the middle of the night, there's someone who's just been messed all over the floor ... and I'm standing there thinking why am I looking at this?"* (2656-18, single-bed room, shared bathroom). The issue of noise levels was not specific to the shared bedrooms. In the single-bed rooms, noise came from participants in adjoining rooms, staff entering the room or talking in the hallways, and environmental features (e.g., banging doors or alarms from nurse call-bells) – *"Hear that door? It starts at 5 o'clock in the morning. The staff door. It just wakes you up"* (2656-01, single-bed room, ensuite).

Privacy was also an issue in both single and shared bedrooms (**sub-theme 3.1 cont.**). Curtains between the beds in the shared bedrooms were appreciated by some, but others saw them as inefficient and wondered, *"why we still haven't moved away from those pull around hospital drapes. ... I find that amazing that we haven't come up with a better system somewhere along the line for privacy."* (2656-13, four-bed room). The relative privacy of the single-bed rooms was generally appreciated, but participants in these rooms did experience some intrusions on their privacy (e.g., noise interruptions and shared bathrooms). Indeed, privacy seemed an issue of the ward environment as a whole, rather than the shared bedroom environment per se. For example, four roommates chose to meet and talk in a waiting area in a hallway on another floor of the facility (see red armchairs in photograph A12.10, Appendix 12),

instead of talking in the four-bed room that they shared with each other. They found this hallway space afforded them more privacy from staff and other patients (see sub-theme 3.2 for further discussion of social interaction in hallways). The participants' choice to go to this waiting area was supported by their nurse on the ward.

Participants recognised that shared bedrooms were the economical choice in a publicly funded hospital and that they offered some benefits (social interaction and support – see sub-theme 3.1 continued below), but wondered if privacy and noise issues could be reduced if the number of beds in the room was decreased from four to two.

Although participants wanted privacy, they did not want to feel isolated. This balance between privacy and isolation was discussed in Theme 2 in the context of participants' dependency and perceived safety, but it was also important in terms of social connection. Just knowing that people were nearby helped those in the single-bed rooms to feel connected with others. The location of the bedroom on the ward impacted this. One participant with aphasia was moved from a single-bed room located off a thoroughfare (between the nurses station and the stairwell) to another single-bed room at the back of the ward and felt that she had been moved from a private space to an isolated space – *“I feel very isolated [in my new room] ... [in my old room] I think just sort of felt like if the door was open you know and people were chatting more [passing by] ... I do like to be very private ... [but] I liked my [old] room”* (2656-18).

Although not all participants wanted to interact with their peers, some felt a social expectation and responsibility to do so. One participant who was independently mobile and did not have language or cognitive impairments, felt especially connected with her roommates and chose to remain in her shared bedroom instead of moving to

a single-bed room when one became available. She felt she *“couldn't leave these people ... And they enjoy the company”* (2656-06, four-bed room). Some participants in single-bed rooms also felt this social expectation; one participant described feeling rude when she shut her bedroom door.

Participants in shared bedrooms connected with each other, found comradeship, common histories or interests, and **supported each other** beyond the boundaries of their bedroom (**sub-theme 3.1 cont.**). Some gestures of support were seemingly minor (e.g., swapping food or sharing a newspaper), but others were vital – *“[My roommate] put her hand on me at one stage and said ... ‘I’ve got a stash of pills at home [for] when it gets too much’ ... I thought, I’ve gotta share that. So, I just whispered to one of the staff”* (2656-06, four-bed room). Although peer interaction and connection occurred in other spaces (e.g., hallways and therapy spaces – see sub-theme 3.2), true **peer support** only occurred between those who shared a bedroom with each other.

Exposure to other participants in **hallways and therapy spaces provided opportunities for connection (sub-theme 3.2)**. Participants in single-bed rooms spoke of talking with other participants in the hallways as they passed by their bedrooms, and some participants chose to spend their time sitting in the hallway, watching people go by – *“you can at least sit here [on a chair in the hallway]. ... Just a different place. ... and you can see the food sta staff ... coming and going”* (2656-11). The waiting area in the hallway on another floor of the hospital (mentioned in sub-theme 3.1) provided a place for participants and visitors to sit and talk outside of the ward. In terms of connecting with other participants, verbal exchange was not essential; just seeing *“people like myself”* (2656-07) in the hallways and therapy areas was enough to promote feelings of comradeship and empathy. Participants naturally

compared themselves to their peers and, although it could be upsetting to see other people in distress, seeing other participants improve in therapy could give a sense of proportion and hope – *“I look out the corner of my eye and see someone better or worse than me and the better ones I know that they have been worse and they’re getting better so that gives me my motivation”* (2656-10). On the other hand, some participants did not notice or interact with the other people in therapy as *“everyone’s doing their own thing ... I don’t take much notice of them”* (2656-19), or the large dimensions of the gym prevented them from feeling part of a community – *“it’s sort of too big and that for me to join anything”* (2656-20).

Many participants with all sorts of impairments, and from both single and shared bedrooms, expressed a desire for designated or **defined communal spaces (sub-theme 3.3)**; areas where they could be around other people and feel welcome, and which did not have another primary purpose (unlike the hallways and therapy spaces). There was a communal lounge on the ward at Case 1 (see Section 5.2), but unfortunately many participants did not know that the lounge existed (see sub-theme 4.1). Only one participant reported going to the lounge to interact with peers. Those who were aware of the lounge found it awkwardly shaped and tucked-away in a location that was hard to find (see floor plans in Appendix 13) – *“not in a good position [and] it’s not really very friendly, the books are everywhere and the shape of the room isn’t really good”* (2656-18). The lounge was often empty and was not large enough to hold many people, so it did not fulfil the primary goal of a communal space; namely, to be around other people – *“there’s hardly ever anybody in [the ward lounge]. I’m gonna to sit there on my own? I might as well come [to my bedroom] and sit in here. Yeah so I don’t use that much. If there was people in there then I would sort of stop and have a bit of a chat with them”* (2656-04). The café, on the

lower ground floor of the building, was the preferred and often utilised destination for participants and their visitors, but it was not open on the weekends (see Section 5.2). Some participants in shared bedrooms went to the lounge with visitors when the café was shut but found it awkwardly shaped and inhospitable.

5.4.2.4 *Theme 4: The environment should be legible and patient-centred*

Participants noticed when aspects of the ward environment were helpful and important for their care, and they were similarly conscious of the times when the environment was inefficient, confusing, or did not suit their needs. This theme has broad implications for participants' experience of the environment and intersects with Themes 1, 2 and 3 above. For example, a perpetual cycle can result when participants' sense of powerlessness and restriction in an institutional environment (Theme 2) is compounded by their own ignorance of the environment, and vice versa. This theme has two sub-themes: 4.1) (Dis)orientation in the physical environment; and 4.2) Convenience and suitability of the environment (fit-for-purpose).

Many participants felt **disorientated** in the hospital environment (**sub-theme 4.1**). They had no knowledge of the layout of the building – “[I] didn’t even know how many floors there were” (2656-06) – and were ignorant of the location, or even the existence, of key spaces such as the ward lounge. It was understandably difficult for participants who could not mobilise independently to familiarise themselves with the building, “No, I’m not up to [going anywhere else in the building] yet. The family have offered but they often bring me up drinks. But no I’m not up to that so ... I don’t know what the building even looks like on the outside. I just know the corridors, the lifts and that’s about it” (2656-17). One participant felt disconcerted by sounds from other patients outside her bedroom and was not able to determine what direction these sounds were coming from – “I don’t know whether this side this side or what ... I

don't know who's in there or anything but just before you come they were swearing ... I just shut the door" (2656-08). As discussed in Themes 1 and 2, illness and mobility issues were not the only reasons for participants choosing not to explore beyond their bedroom; restrictions in the physical environment, a sense of surveillance, and perceived lack of ownership over the space all contributed.

One reason that participants stayed in their bedroom was that they did not know where else to go. They felt that they were not given the verbal or written information they needed to become oriented to the space. Signage could be deliberately misleading (e.g., the false sign on the lift mentioned in Theme 2), but even well-intentioned signage was unclear – *"the sign says sunroom. Oh yeah OK it's solar, it's a place where you get sunlight. It doesn't say that there's tea and coffee and anything like that, and there is, but it doesn't say that, and it was only because I sniff around [that I found it]"* (2656-13). Participants wanted to know more than just the location of spaces; they also wanted to know the purpose of the spaces, who could use them, and any access restrictions (e.g., café opening hours).

Although some participants found the building hard to navigate because it *"all looks the same"* (2656-14), others did recognise distinctive features (e.g., paintings, colours, shapes on the ceiling, etc.) and used these to assist their wayfinding. Some participants were familiar with the local area or had previously visited the hospital as a participant or visitor and so were already somewhat oriented to the space. Although the layout of the hospital as a whole could be confusing, the ward itself was generally legible and easy to navigate because the hallway ran in a loop – *"This ward is good especially because ... you know getting used to it and it is that circle ... you can [find your way back], you know two or three laps or something"* (2656-18). As mentioned in Theme 1, having access to views of the outdoors, and being able to leave the

bedroom and go outside the hospital building, helped participants to understand where their bedroom was situated relative to other spaces, and where the building was situated in the local environment.

Participants noticed when the environment was **convenient to their needs and suitable for their care (sub-theme 4.2)**. In terms of participants' therapy needs, the large size of the therapy gym and the quality of the gym equipment was considered very suitable, *"This equipment. It's remarkable isn't it? ... The things they have to help people. ... it looks to be so simple to use too"* (2656-06). Two participants had even chosen to be transferred to Case 1 because of the quality of the new gym. The upper-limb occupational therapy room, on the other hand, felt quite small to participants (see photograph A12.9, Appendix 12). In terms of independent therapy and practice, the layout of the ward was considered conducive to walking around independently. In addition to the legible shape of the ward (see sub-theme 4.1), participants appreciated the wide hallways and that there were chairs placed at regular intervals, which they could sit on if they got tired while walking.

The bedrooms, however, were less conducive to independent practice. There was not enough bench space in the bedrooms for participants to do their occupational therapy or written speech therapy practice – *"I need more bench space [in the bedroom] cos this [table] always fills up when a meal comes and then I've got to clear. [I need] a couple more of these [tables]"* (2656-10). There was one transitional care bedroom on the ward (see photograph A12.4, Appendix 12). Being in this bedroom gave independently mobile participants an opportunity to practice preparing their meals and living more independently – *"Coffee when you want it. Hot toast (laughs) instead of cold. ... And it's not just about that it's nice to have a coffee or toast ... the reason [for being in this bedroom] is to get used to doing things ..."*

Preparing for home” (2656-18). However, the kitchen in the transitional care bedroom was not well equipped, which impacted its usefulness for participants – *“There was no bowls there was no absolutely nothing. So [my sister] just went out and just went to Coles and brought you know that plastic stuff”* (2656-02).

Although they felt there was plenty of therapy equipment in the gym, participants were aware that some mobility aids and wheelchairs were outdated, and that equipment was in short supply on the ward. This shortage could impact their comfort and dignity – *“we need more hoist[s] for the building because we only have one here ... when participant want to go to the toilet they have to go ... waiting for the hoist to come and to take them to the toilets yeah that’s unfair”* (2656-09). A lack of storage on the ward resulted in some equipment being stored in hallways or bathrooms, which participants noticed and took as a sign that the design of ward was inadequate.

Some participants were quite resourceful in finding things in the environment that they could use to facilitate their therapy and practice. Participants with limited mobility reported using the footboard of their bed to push onto and exercise their legs. There was a wall clock in all of the bedrooms, which participants found useful for orienting themselves in time and for timing their independent exercises. One participant with swallowing difficulties decided to use the clock to make sure that he chewed each mouthful for long enough before swallowing. Participants had ideas about changes that could be made to facilitate their independence. The meal tray and food packaging, for example, was a source of constant frustration for participants with upper limb impairments, and they wondered why they could not be given adapted trays and utensils. As mentioned in sub-theme 2.2, the nurse call-bell was important for the participants’ sense of safety and independence, but it often fell off the bed,

chair, or nearby surface and was then out of reach. Participants had many methods to keep it within reach, including putting it in a draw, using a bull-dog clip to keep it in place, or wrapping the cord around the arm of their chair.

In addition to failing to facilitate independence, there were also aspects of the environment that actively hindered participants' independence, making it difficult for them to appreciate what would otherwise be positive environmental features. For example, the doorway to the private balcony in one of the bedrooms (see bedroom next to the ward lounge in floor plan 1 in Appendix 13) was too narrow for an electric wheelchair to pass through without help, and there was no water source at the tea and coffee station in the ward lounge so participants and visitors had to ask staff to fill up the kettle. Participants found it hard to operate the television, found that their television did not work, or that there was a lack of choice in what to watch. Many brought their own entertainment and communication devices (e.g., smartphones, tablets, radio, etc.) but, as mentioned in sub-theme 2.2, these were dependent on hospital infrastructure. Power points were inconveniently placed, making it hard for participants to charge their personal devices – *“if I want to put my hearing aids on to charge overnight, which I must, otherwise I can't hear anything the next day, I have to get out get my walker go over there and sort it out. It's just not conveniently - what's the word? - arranged”* (2656-19).

There were a number of features in the environment that, through lack of maintenance or lack of attention, had become antithetical to their intended purpose. Some examples included a clock set to the wrong time, the inviting-looking balcony off the ward lounge being locked because it was deemed a trip hazard (see photograph A12.7, Appendix 12), and participants' timetables being placed too far away for the participant to read them. The purported aim of the timetable is to help participants

prepare for therapy, organise their day, and feel in control of their time, but when it is placed too far away to read it can become yet another reminder of participants' dependency.

Some participants who experienced a fall or near-miss fall felt that this could be attributed to environmental factors, such as a dusty floor or a narrow bed, and that the environment had somewhat set them up to fail – *“My bed [at home is] big. Look how little these beds are! Is it any wonder [I] fell out?”* (2656-08).

Participants noticed the age of the ward at Case 1, areas of disrepair, and some worried about the safety of the environment. There were concerns about electrical wiring, plumbing, waterproofing, fittings in the bathrooms, and the safety of the elevators. Indeed, there were some general issues with maintenance: the elevators often broke down (they were replaced soon after the data collection period) and, on one occasion, there was no hot water supply for a few days – *“they lost hot water for three days. I thought you’ll have a participant revolt if you don’t get that fixed. ... they went and got a basin full of hot water and went from there. ... But it’s a pretty poor substitute for a hot shower”* (2656-16).

Figure 5.2 depicts the four interconnected themes as they were expressed in Case 1 (SG).

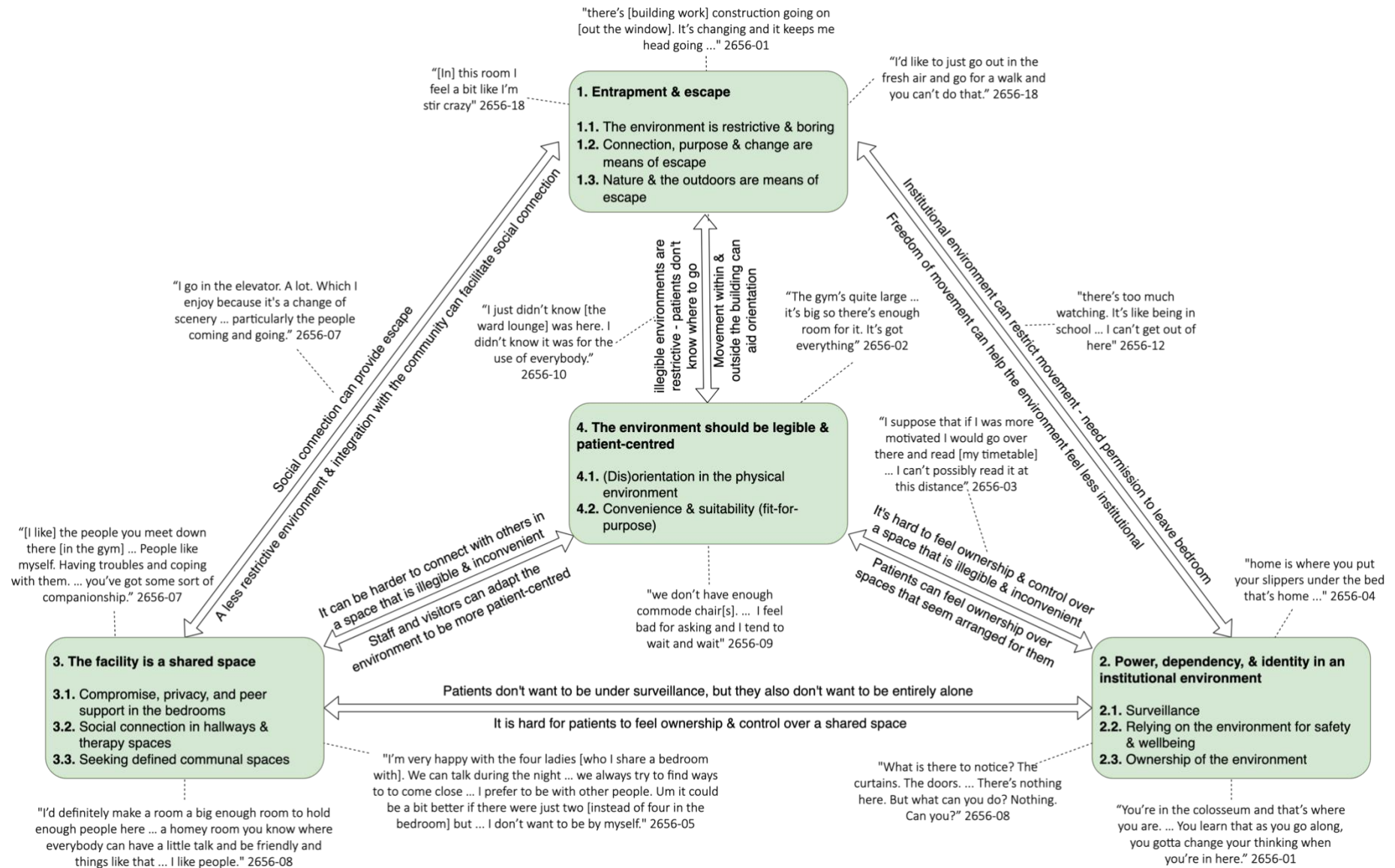


Figure 5.2 Themes, sub-themes, and illustrative quotes from case study 1.

Arrows indicate connections between themes.

5.4.3 ***Themes in Case 2 (Bendigo)***

The themes that emerged from Case 2 (BH) mirrored those from Case 1 (SG), but, unsurprisingly, the differences in participant population, procedures and policy, and physical environment meant that different aspects of the themes emerged from the two cases. This section outlines the themes and sub-themes as they were expressed in Case 2. In order to avoid repetition, this section focuses on the aspects of the themes that were unique to Case 2, or that differed between the cases. Agreement between the cases can be assumed for all aspects of the themes and sub-themes, unless otherwise specified. Figure 5.3 depicts the four interconnected themes as they were expressed in Case 2. Figure 5.3 is almost identical to Figure 5.2, except that it includes only quotes from participants in Case 2. It is interesting to note the many parallels between the quotes in Figure 5.2 and Figure 5.3.

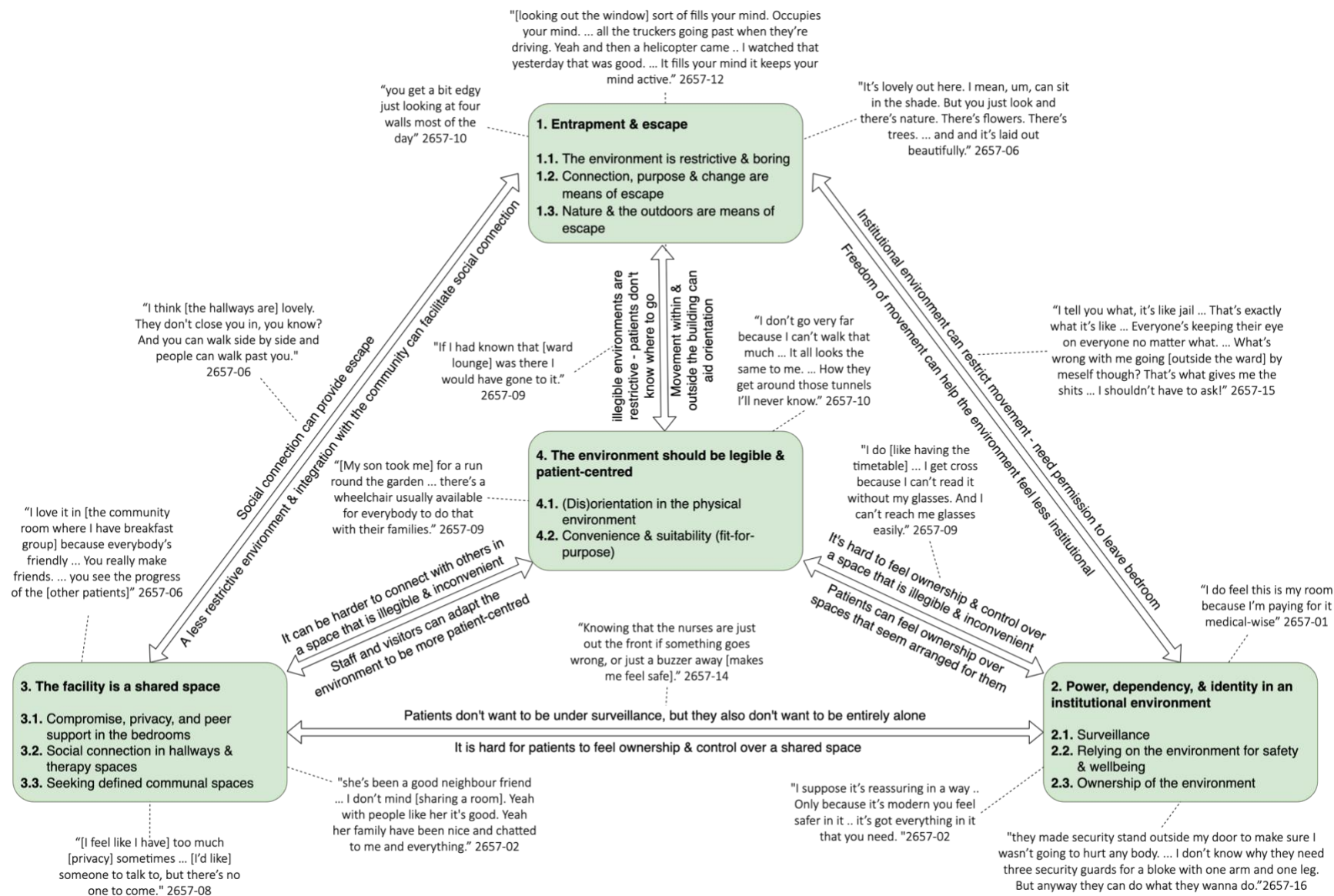


Figure 5.3 Themes, sub-themes, and illustrative quotes from case study 2

Arrows indicate connections between themes.

5.4.3.1 Theme 1: Entrapment and escape

The feeling of being in a **restrictive and boring** environment was also present at Case 2 (**sub-theme 1.1**) – *“just seeing people over and over and over and over and hearing the same things over and over and over and over oh. Just gives you the shits. ... where else is there to bloody go!? Nowhere, is there? That’s what I mean. You’re too enclosed in the place.”* (2657-15). The bedrooms at Case 2 (BH) felt larger on average than at Case 1 (SG) (see Section 5.2 and floor plan 2, Appendix 13). The ceilings were higher, and the windows in the bedrooms were bigger. Some participants noticed and appreciated this sense of space, while others still felt that the bedrooms were quite small – *“I find the [bed]rooms are very good. They’re quite roomy ... one lady I had [as a roommate] thought the rooms were too small, but I don’t find that. I find they’re big and nice”* (2657-06). With only one window in most of the shared bedrooms, participants’ experience of the room could be impacted by their roommates’ use of the dividing curtain – *“There was a lady in this half and she kept this blind closed all the time (laughs). I didn’t see any outdoors. [I felt] sort of closed in you know. Yeah very small and boxy. Small and boxy. Because it’s not really a big area is it? This room is a small room isn’t it?”* (2657-02). Whether participants felt the rooms were big or small did not seem to depend on whether they were in a single or shared bedroom; some shared and some single-bed rooms were smaller and some were larger (see Section 5.2).

Despite the larger bedrooms, the sense of entrapment persisted for at least half of the participants at Case 2, independent of their type of impairment or whether they were in a single or shared bedroom. As at Case 1, this sense of entrapment motivated some participants towards recovery – *“deep down we really hate the place, everyone does. You just wanna get out of here but you also know that you’ve got to get better*

before we can” (2657-14), while others felt frustrated or despondent (see Theme 2).

Connection to other people and to the outside world, variety and change in the environment, and purposeful activities, such as therapy, all helped bring a sense of escape (**sub-theme 1.2**). The large windows in the bedrooms and the view across Bendigo provided connection and variety, and also helped participants to orient themselves in time and space (see sub-theme 2.3) – *“I sit there [at the window in my bedroom] and have breakfast and I look out and watch the people going to work. Or about 5 o’clock I’ll sit up to see if it’s daylight. ... if I sit at the window, I can see people moving around ... it’s just company”* (2657-08). Some participants found the hospital itself motivating and symbolic of progress – *“I get motivated whenever I walk in here ... knowing that if I work hard at improving myself I can go home”* (2657-14).

However, as at Case 1, participants at Case 2 expressed a desire to get out of the ward and hospital environment and to escape to **nature and the outdoors (sub-theme 1.3)** – *“it’s good to be outside, out of this place. Lifts the spirits a bit. Like I said it’s like a jail up here sometimes, so it feels good to get out of here”* (2657-16). Some participants at Case 2, some of whom relied on others to move around, felt that they would participate in more physical activity if they were outdoors; they described themselves as *“an outdoors person”* (2657-06), which suggests that access to the outdoors was important for their identity and sense of ownership over the environment (see sub-theme 2.3). As mentioned in Section 5.2, the rehabilitation ward at Case 2 was on the sixth floor (while the ward at Case 1 was on the first floor). The ward’s distance from the ground floor at Case 2 made some participants feel more disconnected from the outside, whereas others who were less mobile appreciated the resulting natural light and views of the outdoors from the sixth floor – *“I like the view*

[in my bedroom]. Being up higher ... it's generally nice and sunny here. I like lying in the sun" (2657-14).

5.4.3.2 *Theme 2: Power, dependency, and identity in an institutional environment*

As at Case 1, participants at Case 2 recognised that they were in an institutional environment where staff and procedures had power over participants, and again, some likened the environment to a “*prison*” (2657-09, 2657-15, 2657-16). Not all participants at Case 2 experienced a sense of being under **surveillance (sub-theme 2.1)**, but for those who did, it felt quite pervasive and upsetting, again prompting at least one participant (who was independently mobile but with cognitive impairments) to propose self-discharge. Bed alarms were not mentioned as frequently at Case 2, but other forms of surveillance were, such as being watched. One participant who was dependent for mobilisation had security guards assigned to his bedroom in what he described as a disproportionate response to a threat he had made to a staff member. Ironically, the security guards helped the participant to feel safe. Another participant (who was independently mobile but with cognitive impairments) felt that staff became annoyed with him if he left his room and sat in the hallway. Explicit restrictions placed on participants’ movements were sometimes perceived as punishments – “*All the rules they give me that I gotta live by. I feel a bit singled out sometimes. I don’t know [if they are] giving anybody else these rules or is it just me. ... It makes me angry and depressed. Cos I hate being locked up in hospital ... I haven’t committed any crimes. I just had a stroke which was out of my control. It just happened to me. And I get locked in here like I’ve done something wrong*” (2657-16).

Participants **relied on this physical environment for their safety and well-being (sub-theme 2.2)**. Compared to Case 1 (SG), the building at Case 2 (BH) was very

modern (see photographs in Appendix 12). Participants' reactions to this aesthetic fell broadly into one of two categories. The first category included participants who felt that the modern look was uplifting and reassuring. These participants felt that a clean looking environment was indicative of good care, they felt that the balance of colours in the space was good (neutral tones with some highlights of colour), and the clinical aesthetic helped them to feel positive – *“when things are like fresh, clean and that you just think oh yeah I feel good in myself, whereas if it's dull and doesn't look overly great you think, oh well, you just tend to go down that dull kind of track”* (2657-03). They noticed the new medical equipment, the large rooms, and the modern features and felt that this was indicative of good care – *“in the bathroom they've got two showers in there ... so just shows you it's pretty good ... it's [a] ginormous bathroom. It's lovely. ... very posh”* (2657-01). The second category included participants who disliked the modern, clinical look. These participants found the aesthetics grey and boring at best, and institutional at worst – *“I just find it depressing. ... It feels a bit like a jail. Just the atmosphere and that. And the colour scheme. It needs a bit more colour. Make it a bit more lively. I don't know red, blue, green”* (2657-16). A few participants suggested having more artwork in the bedrooms, especially colourful pictures like children's paintings.

As mentioned in sub-theme 1.1, the bedrooms at Case 2 were generally larger compared to Case 1. Indeed, the whole building at Case 2 was larger, including the hallways, café, and outdoor areas – everywhere except for the gym (the size of the gym is discussed further in sub-theme 4.2). The open spaces, and the expansive views from the windows, made the building seem less institutional for some participants – *“I find this building is very spacious. You don't feel as if you're in a hospital environment really”* (2657-06). Participants who could leave the ward appreciated

spending time in the hospital café. This gave participants a sense of normalcy, and some suggested that access to additional every-day services outside the ward, such as a hairdresser, would be similarly beneficial – *“when me wife comes we go down and have a coffee down on the ground floor ... it’s nice. Doesn’t make you feel like you’re in hospital ... you see people come and go and you know yeah sort of sort of feeling normal ... feeling of normalcy ... The people and the trees and the yeah and the environment itself is quite nice”* (2657-04).

The hospital infrastructure at Case 2 was sufficient to support participants’ personal entertainment devices (e.g., good internet connection or enough power outlets) and the participant entertainment unit provided by the hospital was modern and not in need of repair. However, some participants did find it difficult to operate the entertainment unit (see sub-theme 4.2), and some younger participants felt that the entertainment options on it were limited compared to what they could access at home – *“[The participant entertainment unit] could be a little bit more um updated like if they had Netflix or something on there if you could watch something like a series or something ... [Whether it’s easy to use is] a little bit on and off, hit and miss, needs to be a bit simpler. I don’t know how older people would get on trying to use it you know”* (2656-04).

For the most part, the sub-theme of **ownership of the environment (sub-theme 2.3)** manifested similarly at both cases. Participants noticed that the gym, and other therapy areas such as the community breakfast room, were set up for them. Therapists did facilitate participants’ movements around and outside the ward in supervised therapy activities, and sometimes provided permission for participants to do so independently. However, requiring permission was a problem for some participants who felt that they *“shouldn’t have to ask”* (2657-15). The main

difference between the cases for this sub-theme was the extent to which participants could personalise their bedrooms. Staff often moved things around in the bedrooms, or tidied things away. Participants at Case 2 were not allowed to stick anything on the walls of their bedroom as the building managers did not want the paintwork to be affected (see Section 5.2). Participants tried to work around this by sticking things on the windows or the powder coated doors, and one participant suggested providing a specific envelope, or plastic pocket, on the wall for participants to display their personal pictures – *“not every picture suits a person. So that’s why I think that [having a space for participants to put their own pictures] is good because you can put up something like that of your family. Or your dog (laughs) or something ... so you can just have a little thing slip up there [on the wall] where you can put a little envelope type thing”* (2657-09).

5.4.3.3 Theme 3: The rehabilitation facility is a shared space

The sub-theme of **compromise, privacy, and peer support in the bedrooms (sub-theme 3.1)** was largely similar in both cases. Participants in both single and shared bedrooms reported issues of privacy and compromise, especially related to noise. Noise came from roommates, staff in the hallways, and the nurse call-bell alarm, which was louder and more frequent at Case 2 than at Case 1 – *“that bloody bell ... Pain in the neck! ... I’ve got hearing aids which make it worse, so it sounds as if it’s right in my ear”* (2657-06). The noises that patients complained of at Case 1 (e.g., squeaking door) were due to maintenance issues, whereas the noise from the nurse call bell at Case 2 was intentional and by design. Hearing people talking in the hallways could be comforting, but it was also a cause of anxiety for some participants, especially at night and if the source of the noise was unknown – *“it’s very, very noisy up and down this corridor ... I think every hospital should have a little thought about*

how they can soundproof ... Or make some of the staff more aware. Particularly at night. ... it's a bit confronting especially when it's near your door or your wall. [I think] Who's, what are they gonna do? Are they gonna break into my room or is somebody going to accidentally come in here?" (2657-09).

Although there were some instances of peer support in the bedrooms at Case 2, these were not as pronounced as at Case 1. Some rehabilitation participants at Case 2 shared a room with patients who had been admitted under a different classification, i.e., for complex medical care rather than for rehabilitation (see Section 5.2). Some of these complex patients were too unwell or too cognitively impaired to communicate, which made it harder to form a social connection and harder to negotiate compromise in a shared bedroom. Some participants dealt with this by spending less time in their bedroom – *"I find it hard to have a conversation actually in the room. ... normally [my roommate's] TV's on very loud. I can't hear what people are saying ... I head to this area here [lounge nook in hallway], might only be 10 minutes but just to get a breather out of the [bed]room ... I think it's [my roommate] that just affects me!" (2657-03).* Despite the challenges in forming social connection, some rehabilitation participants did feel a responsibility to look out for their roommates – *"Last night we had a, we didn't sleep too well because [my roommate] was very restless all night, but I don't mind that because she's got dementia, and I nursed my husband with dementia so I know she can't help sort of singing out or trying to get out of bed, when she shouldn't, um so I don't mind, you know, hitting the buzzer to sort of let the [nurses] know she's on her way out" (2657-06).*

Participants experienced **social connection in hallways and therapy spaces (sub-theme 3.2)**. The therapy spaces, including the gym and the community room where breakfast group was held, were social spaces where participants could interact

and compare their progress to others'. Participants noted that the gym could be too crowded at times (see sub-theme 4.2 for further discussion of the size of the gym). As in Case 1, participants' social connection in hallways was with visitors and staff, as well as with other participants. The hallways were wide and easy for participants to walk along (see sub-themes 1.1 and 4.2). The lounge nooks in the hallways were often utilised by participants (see photograph A12.18, Appendix 12). They spent time in these spaces alone or with visitors, but not often with other patients. It was somewhere for people to sit where they could be private but not isolated, and it offered an escape from the bedroom (see sub-theme 3.1 above). Participants could exert some control over the space without disturbing others – *"I just listen to me wireless [when I sit out in the lounge nook]. And don't interfere with [my roommate] in the bedroom. Because I'm a bit deaf I can turn it up a little bit"* (2657-12).

Although participants appreciated the lounge nooks in the hallways, and used them regularly, they did not operate as **defined communal spaces (sub-theme 3.3)** where participants could meet and interact with each other. Participants felt that they would not sit in a lounge nook if there was already another participant there – *"I wouldn't come in here if anyone [else] was here ... because they've probably already started something or they're doing something and yeah I would just I would walk away ... Back to the [bed]room"* (2657-03). The ward lounge was appreciated at Case 2, and although some participants felt it was a bit small, it was perhaps more functional than at Case 1 – *"[The lounge is] quite a good space. Yeah ah they have books and TV there and DVDs and stuff so games and whatever so yes I'm not sure how much it's utilized but yeah. But it was a good space to do [stroke morning tea] ... there wasn't people coming or going all the time or anything you know you had your*

own space yeah and it wasn't threatening or anything, wasn't medical apparatus everywhere" (2656-04).

In addition to the lounge nooks and the ward lounge, there were other spaces at Case 2 where participants could go with visitors, including a number of cafes and different outdoor seating areas. Many participants utilised these, although there were some issues with awareness of these spaces and information provision (see sub-theme 4.1). Having access to these spaces helped participants to feel some escape from the ward (see Theme 1) – “[I] come down [to the café with my daughter] and have a coffee. ... We can talk to one another in private ... well you're not crammed in a [bed]room. ... [or] we just come and sit [in the garden out the front of the hospital] and yarn and talk” (2656-05).

5.4.3.4 Theme 4: The environment should be legible and patient-centred

Disorientation was an issue for participants at Case 2 (BH) (**sub-theme 4.1**), perhaps to an even greater extent than it was at Case 1 (SG). Participants felt that all the hallways looked the same, like a “*bloody rabbit warren*” (2657-05), and that there should be more signage. The hallway in the ward had a similar shape as the one at Case 1, but there were very few distinctive features in the hallway at Case 2. As mentioned in sub-theme 2.3, participants could not stick anything on their bedroom walls. This rule also applied to staff, so the walls of the ward were bare, except for some notices in designated areas (see photograph A12.16, Appendix 12). The expansive views from the windows helped with orientation to the external surroundings; some participants pointed out key Bendigo landmarks from their bedroom. The ward lounge was in a much more prominent position at Case 2 than at Case 1, and most participants were aware of the ward lounge at Case 2, but not all.

Some participants found it difficult to locate their bedroom. One participant stuck a painting (given to him by his young son) on the outside of his bedroom door so that he could identify which room was his as he came down the hallway, but the painting was removed by staff (the limitations of personalising the bedrooms at Case 2 was discussed further in sub-theme 2.3). Most participants felt unfamiliar with the hospital environment and that there were limited places to visit. They felt that their movements were restricted by their disabilities, physical barriers (e.g., the therapy garden was off a different ward and the door was often locked), and hospital procedures (see Themes 1 and 2), and that they were not given enough information about how to access key spaces. An exception to this was one participant who was close to discharge and who had been given her 'green card' by staff which gave her permission to walk around the hospital independently.

Participants noticed when the environment was **convenient to their needs and suitable for their care (i.e., fit-for-purpose) (sub-theme 4.2)**. In terms of participants' therapy needs, they noticed that the therapy equipment was modern and found this encouraging – *“the equipment they’ve got [in] the gym ... they’ve got really good stuff, that’s fairly motivating you know. I mean if you walked in and everything was dirty and rotten and falling apart and that that wouldn’t be inspirational or motivating, but everything seems to be pretty well state of the art you know which is good ... like they know what they’re doing”* (2657-04). Participants appreciated having mirrors in the gym at Case 2; one participant at Case 1 noted that they felt this was something that was missing from their gym. Compared to Case 1, the gym at Case 2 was quite small (see Section 5.2). Participants felt that size of the gym impacted the quality and efficiency of their therapy time – *“[we are] desperately in need of more space [in the gym] cos everybody’s getting around each other”*

(2657-09). There were often participants waiting outside the gym in a seating area in the hallway dedicated to that purpose – *“the first day I went [to the gym] was quite a few people sitting [in the waiting area in the hallway] in their wheelchairs waiting for their turn”* (2656-01).

Apart from the gym, the rest of the building was much larger at Case 2 than at Case 1 (e.g., the size of the bedrooms as discussed in sub-theme 1.1). Although the hallways of the ward could be confusing to navigate, participants did appreciate that the hallways felt spacious and they indicated that this impacted their independent practice. The hallways at Case 2 are wider and longer than at Case 1, with high ceilings and windows at the end. The spacious hallways provided some motivation and support for physical activity – *“these hallways I think they’re great because they’re open. So you can actually see down to the other end. See a bit further really than what you want to go, which is good. ... [you can look at the distance and think to yourself] okay right well I’ve got all that space and yeah I can handle it”* (2657-03). Mobility equipment was more readily available at Case 2 than at Case 1, and was more modern and generally easier to use, which made it easier for some participants to move around alone or with visitors.

In general, there were few maintenance or safety concerns at Case 2, as would be expected in a new hospital. The issues with convenience and suitability of the environment were therefore caused by the original design not being patient-centred or a lack of support from procedures, rather than a case of disrepair. For example, there was an ‘Environmental Enrichment’ station in the hallway at Case 2, which contained games and activities for patients and had been placed there following the completion of an Environmental Enrichment research project (see photograph A12.16, Appendix 12). None of the participants at Case 2 mentioned this Environmental Enrichment

station, and I did not observe it being used during the data collection period. The reasons for the lack of use are unknown, but it may have been a combination of its location (it was not in a central location and participants could not use it without blocking the hallway) and a lack of information provision and support (i.e., showing participants how to use it and explaining the benefits).

A number of things that impacted participants' independence at Case 1 (SG) were also an issue at Case 2 (BH). The meal tray and food packaging, for example, were the same at both cases and were a constant frustration for participants with upper limb impairments. Other examples include that there was no light feature that participants could reach from their bedside, and the temperature in the bedrooms was difficult for participants to control. The window blinds at Case 2 were more versatile and useful for controlling light levels than those at Case 1. These blinds had two layers so that participants could choose whether to have their blinds open, shaded (block out some light but still able to see the view), or closed. However, these curtains were not easy for participants to operate independently. Some of the other modern features in the hospital were similarly difficult for participants to operate. The participant entertainment units were the central portal for participants to access entertainment, use their telephone, internet, and order their food from the hospital menu. Participants therefore needed to use these units many times each day, but some found them difficult to use and resorted to asking staff for help. Participants with impaired upper limb mobility found it difficult to operate the touchscreen and the units required the participant's birthdate to be entered before each use, which was difficult for participants with cognitive impairments.

As at Case 1, the participant's timetable and other key notices were often placed in a position where they could not be seen by the participant. However, unlike

at Case 1, this position was determined by the original design of the bedroom, rather than being under the day-to-day control of staff. There was a designated whiteboard on the wall of each bedroom, and this was the only place where staff could display notices. In addition, there were no clocks in the bedrooms at Case 2, and this was noticed by participants, but the building regulations prevented staff from easily adding these to the bedrooms.

5.4.4 ***Cross-case comparison***

Participants' experiences of the physical environment at both cases are summarised into the four themes: 1) Entrapment and escape; 2) Power, dependency, and identity in an institutional environment; 3) The rehabilitation facility is a shared space; and 4) The environment should be legible and patient-centred. There were differences in how the patient experience manifested at each case which reflected differences in the physical environment at the two cases. These differences notwithstanding, participants' experiences at both cases were, on the whole, quite similar, despite the differences in the physical environment and the differences in patient competencies. Similarities and differences in the participants' experience at both cases can be summarised as follows:

- Feelings of entrapment persisted at Case 2 (BH) despite the larger rooms and larger windows.
- Connection to the outside world (other people, views), variety and change, and purposeful activities helped to alleviate the sense of entrapment and boredom at both cases.
- Participants at both cases desired a connection to the outdoors. Getting outdoors was perhaps harder to achieve in Case 2 (BH) because the ward was on a higher floor.

- The physical environment at both cases felt institutional (to some participants), even though the type of surveillance and the aesthetics were different between the cases.
- The aesthetics of the physical environment of the bedrooms at Case 1 (SG) were experienced as dull, although some staff areas were perceived to be more colourful, while the new, modern aesthetics at Case 2 (BH) were motivating and uplifting for some patients, but considered too clinical by others, or grey and boring.
- Participants at both cases felt a sense of ownership of the therapy areas and made efforts to personalise their rooms, but this was harder for participants at Case 2 (BH) because of the restrictions on hanging anything on the walls.
- At both cases, participants in both single and shared bedrooms reported issues with compromise and privacy. The mixed patient cohort (not all rehabilitation) at Case 2 (BH) made it harder for participants in a shared room to experience true peer-support with their roommates.
- Therapy spaces and hallways were a place of social connection at both cases, but the lounge nooks in the hallways at Case 2 (BH) were not just used for social connection; they were used as an escape – a private, but not isolated space where participants felt they had some control.
- Participants at both cases appreciated communal spaces.
- Orientation in the building was an issue at both cases but was exacerbated at Case 2 (BH) by the regulations about hanging things on the walls, which resulted in fewer obvious landmarks.

- Participants at both cases felt that the therapy areas were fit-for-purpose, though the size of the gym at Case 2 (BH) may have impacted the efficiency of therapy. The hallways and the shape of the ward at both cases facilitated physical activity.
- The older building at Case 1 (SG) resulted in some maintenance concerns and equipment shortages, which were not experienced at Case 2 (BH), but the new technology at Case 2 introduced complications for patients that were not a problem in the low-tech environment of Case 1 (e.g., touch screens).
- Participants at both cases experienced issues with convenience and suitability in the environment, which were a result of a mismatch between the physical environment and staff procedures. The patient timetable at both cases, for example, was often placed too far away for the participant to see.

5.5 Discussion

This chapter presented part of the results of a multiple-case study of two rehabilitation facilities in Victoria, including description of the physical environment and patient cohort, and qualitative results. The physical environment and patient cohort of the cases were similar in some ways and different in others, but despite these differences, interviews with patients revealed four themes common to both cases. The first part of this discussion will outline how these themes relate to patients' behaviour, emotional well-being, and safety in these spaces (addressing research

question 1, see Figure 5.1). The second part of this discussion will consider the strengths and limitations of the methods and measures reported in this chapter.

5.5.1 ***Patient behaviour***

The entrapment that participants felt in their bedrooms (Theme 1) prompted some physically independent participants to seek out (physical, cognitive, or social) activity. However, most participants, especially those who were dependent for mobility, associated this entrapment with inactivity and felt that going out of their bedroom and out of the ward would be a good way to increase their activity. Theme 2 ‘Power, dependency, and identity in an institutional environment’ suggests that patients’ lack of activity was likely exacerbated by the powerlessness they felt over their environment. The interviews revealed power imbalances between staff and patients, which were reflected in the environment and which caused participants to modify their behaviour and feel less autonomous (see sub-theme 2.3). The intention of the surveillance measures at both cases was to improve patient safety, but this surveillance – the bed alarms and being watched – was part of what made participants feel that they did not have permission to go or be anywhere except their bedroom. Findings suggest that extended time in the bedroom and patients’ perceived powerlessness likely played a role in how much activity they participated in. The issue of perceived powerlessness will be discussed further in Chapters 7 and 8.

The quality and availability of equipment to support physical activity was important to patients (Theme 4): good equipment could facilitate practice in the gym, and poor equipment could be a barrier to independent mobility (e.g., outdated wheelchairs). Technology and infrastructure also had the potential to either help or hinder patients’ cognitive activity (Theme 4). For example, entertainment technology could provide opportunities for cognitive activity (e.g., video chat with family or

playing games), but this technology became counterproductive when patients could not operate it independently (e.g., because of touch screens or limited access to power sockets).

As in previous literature, patients in this present study expressed a desire for dedicated communal spaces for social activity (Killington et al., 2019). Our findings suggest that simply making communal spaces available does not ensure that they will be used. These shared spaces need to be large enough, and they need to be signposted or advertised adequately so that people can locate them. Participants reported not only a lack of information about the location of key spaces, but in some instances did not even know they existed. Previous research has shown that poor wayfinding can be a barrier to physical activity in inpatient stroke rehabilitation (Kevdzija & Marquardt, 2018). Good wayfinding ensures that sufficient information is provided, whether this be through visual landmarks, signage, written pamphlets (e.g., placed at the bedside), or verbal communication between staff and patients (Short, Reay, & Gilderdale, 2017).

Shared bedrooms provided important opportunities for social interaction and peer support in the present study, but these opportunities depended on roommates' cognitive ability to interact. The competencies of roommates is an important consideration since, as explained in Chapter 2, it is not unusual for stroke patients to be admitted to a general rehabilitation ward and therefore share with patients of varied levels of ability and impairment. Room allocation is a difficult task requiring staff to assess an array of competing needs, including cost, infection, gender, distance from the nurses' station, and disturbance to other patients. Patients' individual cognitive states and the potential for positive socialisation and interaction with roommates should be considered alongside these needs.

Patients in both single and shared bedrooms in the present study experienced noise and sleep disturbances. This is significant because previous research has suggested single-bed rooms as a means to reduce night-time noise in hospital (Ulrich et al., 2008). The experiences of participants in the present study suggest that noise disturbances come from many other sources besides roommates, including noise from adjoining rooms, staff in hallways, nurse call-bells, banging doors, and motion sensors. Environmental interventions such as insulation, soundproofing, alarm design, and alternatives to motion sensors could be considered in order to reduce noise disturbances and sleep interruptions.

5.5.2 *Patient emotional well-being*

Boredom has been defined as a multidimensional state including: 1) disengagement (i.e., disconnection with the surrounding environment and unfulfilled desire to be engaged in satisfying activity), 2) high and low arousal (agitated high arousal or lethargic low arousal), 3) inability to focus attention, and 4) experiencing a slow passage of time (see Section 4.8.2.4). This definition of boredom is consistent with the experiences described by participants in this study. For example, participants reacted to being alone in their bedroom for a long period of time by either feeling despondent (low arousal) or by seeking out activity (high arousal), and they described feeling trapped in time as well as space (passage of time) (Theme 1). Previous qualitative studies have similarly indicated that patients in inpatient rehabilitation frequently feel bored (Luker et al., 2015). We found that patients value variety, change, and purpose in their physical environment; these qualities help to provide some connection with their surroundings, relieve boredom, and lift their mood.

Previous qualitative research has suggested that patients in rehabilitation do not believe it is within their power to make changes to the environment (Killington et

al., 2019). The concept of ownership of the environment, as defined in the present study, is more nuanced than the concept of perceived power or agency over an environment. Ownership, as it is defined in this thesis, incorporates several ideas, including the extent to which a person feels they belong in the space (identity, personalising the space), how much they feel the space belongs to them (control, privacy, freedom of movement), and how engaged and invested they feel in the space (ability or interest to make change). As mentioned in Section 1.4.1, for an environment to be patient-centred it must meet the needs of the patient, or be adaptable to meet these needs, empower the patient, and give them control (Leplege et al., 2007; Scholl et al., 2014). The results of the present study suggest that a patient-centred environment can help patients to feel a sense of ownership. Participants felt a sense of ownership in the gym, for example, because they understood that the space was for them, and this understanding was important for their motivation and feeling of control. Conversely, aspects of the environment that were not patient-centred (e.g., unmaintained or inappropriate technology, equipment shortages, disorientation in the environment, and even power socket placement) reminded participants of their lack of ownership over the environment. The experiences described by participants suggest that patient-centred design should be applied to all aspects of the environment, as even the smallest feature or design choice can impact a patient's sense of ownership.

Participants felt a varying amount of ownership over their bedrooms. Building policy and the presence or absence of roommates meant that some patients could personalise their bedrooms more than others. Those in a shared room lacked private space meaning that any modifications to personalise their room may have impacted their roommates. The issue of privacy was not unique to patients in shared bedrooms – patients in both single and shared bedrooms struggled to find privacy on the ward,

and those sharing a bathroom found this especially hard. The results of the present study suggest that privacy must be weighed against the issue of isolation. As mentioned in Section 5.5.1 above, many participants in shared bedrooms appreciated the company of roommates. Previous qualitative studies have similarly found that some patients in rehabilitation are willing to forgo a single-bed room in order to avoid isolation (Killington et al., 2019).

There appears to be an important difference for patients between choosing to be alone (privacy) and being alone without choice (isolation). Many participants in the present study sought out somewhat public places (e.g., hallways, waiting areas, or lounge nooks). These spaces allowed a measure of privacy, without leading to isolation. Many participants, especially those who were dependent for mobility or who were in a bedroom in a secluded section of the ward, worried about being alone and found that this affected their mood. The potential for isolation in rehabilitation is worrying, especially considering the extended length of stay of some patients (more than six weeks on average at both cases). Loneliness has great impacts for emotional well-being and is a significant problem in older populations and people with a disability living in the community (Gerst-Emerson & Jayawardhana, 2015; Paul, Ayis, & Ebrahim, 2006). Hospitals, which are full of people, could be designed to promote social connection and so offer a reprieve from the loneliness that people may experience elsewhere.

5.5.3 ***Patient safety***

In addition to impacting patients' emotional well-being, participants who felt isolated in their bedroom also felt unsafe. The nurse call-bell helped with this, but was not always reliable, leading some participants to arrange for a nurse to check on them at pre-specified times. Participants in shared bedrooms at both cases described taking

care of their roommates and helping to keep each other emotionally and physically safe, even in matters of life or death (Theme 3). As mentioned in Section 1.4.1, previous studies have found associations between physical safety and room type, with patients in shared bedrooms experiencing fewer falls than patients in single-bed rooms (Shannon et al., 2018). Future research could investigate whether there are associations between the number of beds in the room and patients' psychological safety.

On the whole, the interviews in this study revealed more about patients' perceptions of their safety than about their actual safety. Participants expressed worry about older, visibly unmaintained equipment and infrastructure being unsafe. While the present study found no evidence of such equipment or infrastructure posing direct risk to patient safety, it is important to recognise and respond to these concerns in order to minimise patients' worry. The nurse call-bell also caused concern for participants who worried that they might drop it, or that it may not be functioning properly, or that it would not prompt a timely response from the nurse, thereby leaving the patient helpless and alone. For patients to feel reassured, a reliable system for requesting help when needed requires accessible, unfailing technology as well as available, responsive nursing staff. Interventions such as hourly nursing rounds have been trialled in a number of settings and have led to moderate improvements in patients' perception of nurse responsiveness and a moderate reduction in patient falls (Mitchell, Lavenberg, Trotta, & Umscheid, 2014). Physical environments that minimise patient isolation could reduce the need for such systems.

The surveillance measures at both cases were intended to improve patient safety by ensuring that staff were aware of patients' movements. However, we observed that particular surveillance measures can prompt some patients to engage in

counterproductive and unsafe behaviour, such as sneaking out of the hospital or proposing self-discharge in response to feeling watched. While it is important for staff to assist in keeping patients safe, previous research has found no support for some forms of surveillance, such as physical restraints (e.g., motion sensors or bed alarms) to reduce patient falls (Shorr et al., 2002). Indeed, efforts to reduce the use of these restraints have resulted in a reduction of patient falls and injuries (Amato, Salter, & Mion, 2006; Enns, Rhemtulla, Ewa, Fruetel, & Holroyd-Leduc, 2014).

The present study has already highlighted the importance of patient choice in regard to the distinction between privacy and isolation (see above). There appears to be a similarly important distinction for patients between choosing to be watched (asking for observation or using the call-bell) and being watched without choice (surveillance). Power and control are perhaps as important for patient safety as they are for patients' emotional well-being and behaviour.

5.5.4 *The methods of data collection*

This section explores the strengths and limitations of the methods and measures used to assess the physical environment (field notes and checklists), patient competencies (demographic and clinical variables), and patient experiences (semi-structured walk-through interviews).

5.5.4.1 *The physical environment: Field notes and checklists*

Overall, scores on the checklists largely agreed with the qualitative observations from field notes, but this is perhaps unsurprising since I completed both the checklists and the field notes myself. The checklists offered an understandably less nuanced impression of the physical environment than the fieldnotes (two checklists were completed, see Section 4.8.1.2). Details from the fieldnotes were

necessary for interpreting the scores on the checklists, and for identifying when a similar score on a certain category belied more intricate differences beneath (e.g., ‘Access’, see Section 5.2.3).

Ultimately, both the checklists and field notes are subjective assessments of the physical environment. Appendix 14 outlines the differences between the practice checklist scores completed prior to data collection, and the final scores completed at the end of data collection. Much of the discrepancy between the practice and final scores can be accounted for by some items having remained unanswered during the practice completion because more detailed knowledge of the physical environment was needed in order to answer them properly. I could not complete the checklists in full until I was familiar with the physical environment and had consulted with staff regarding some of the items. The checklist developers recommend that the checklists can be completed by any person with knowledge of hospital building design, but the differences between the practice and final scores in this study suggest that the checklists should be completed by people who are familiar with the particular environment in question.

The physical environment at Case 1 (SG) has a many-layered history and is more varied and complex than at Case 2 (BH) (see Section 5.2.1). It was therefore more difficult to score the checklist for Case 1 (SG) so that it reflected the building as a whole. The final checklist results indicate that the newer building (Case 2) is a higher quality building than Case 1, but this may be a feature of the physical environment at Case 2 having been more coherent, rather than it being higher quality per se. Ultimately, these checklists are generic and were not designed to assess rehabilitation environments specifically. The ability to weight the items in the checklist is useful (see Section 4.8.1.2) but it is subjective and can only be applied to

items that already exist on the checklist. There are no items on the checklists that address opportunities for physical activity for patients, for example, so this cannot be weighted to reflect its importance in rehabilitation. It would be beneficial to develop a rehabilitation-specific checklist for future research, and to conduct inter-rater reliability testing as well as repeatability testing in future use of such checklists.

5.5.4.2 *Patient competencies: Demographic and clinical characteristics*

The broad eligibility criteria and flexible participation options utilised in this study allowed for the intended, diverse sample of participants, including people with and without language impairments, cognitive impairments, and mobility impairments. Good approach and consent rates were achieved, so the sample of participants is likely to be representative of the patient population at both cases during the data collection period. As well as there being a range of impairment types, there was a wide range of impairment levels in the sample. Length of stay varied widely in both cases from one or two weeks to more than four months (see Table 5.5, page 132). One patient with language impairments from each case declined because of concerns regarding reading and writing, but in general the adapted study materials and participation procedures likely helped more people with language impairments to participate than would otherwise have been the case. Interestingly, many participants without language or cognitive impairments chose to use the adapted materials because, even though they could read and understand the standard version, they appreciated the large text and simple language in the aphasia-friendly documents. Future research could consider producing only aphasia-friendly documents as this would make the research more accessible for all.

As mentioned in Section 5.3.5, the participants from Case 2 (BH) were generally more unwell than the participants from Case 1 (SG). This is not unexpected

since the patient profile is different at regional hospitals compared to metropolitan hospitals (Stroke Foundation, 2017). Case 2 is a major regional hub, taking all patients from a large geographic area, whereas Case 1 is one of many metropolitan services. Many of the patient experiences reported in this study were common to participants at both cases, to participants in single and shared bedrooms, and to participants with different types of impairments. The themes reported in this study are therefore widely relevant to stroke patients in rehabilitation.

5.5.4.3 *Patient experiences: Interviews*

The walk-through semi-structured interview was designed to be accessible for patients with language and cognitive impairments (see Section 4.8.2.2). Participants could choose the route of their interview, to draw or take pictures, or to complete the interview in their bedroom instead of roving around the ward. All participants were able to complete the interview, which is testament to the feasibility of using a flexible interview design with this patient cohort. The walk-through (or photograph-prompted) format helped to keep participants focused on the physical environment when relaying their experiences.

Conducting interviews with people with aphasia can be challenging (Prior, Miller, Campbell, Linegar, & Peterson, 2020). Video recordings have been recommended as a means to capture non-verbal information and allow the researcher to later review sections of unclear language in context (Bronken & Kirkevold, 2013; Luck & Rose, 2007). Field notes were used to a similar end in this present study, and these were certainly useful to refer to during analysis but were likely less thorough than a visual record.

The interviews generated a large amount of data at both cases. The average duration of the interviews was shorter in Case 2 (BH) as compared to Case 1 (SG)

(see Section 5.4). This may have been because the participants at Case 2 were more unwell than those at Case 1 (see Table 5.5, page 132). There was no indication during data collection or analysis that the shorter average duration at Case 2 resulted in less data per participant or lower quality data. The mirroring of the themes at Case 1 and Case 2 indicates that both cases likely reached saturation.

The peer review workshop and double-coding aided in checking the reliability and validity of data interpretation. The workshop was especially helpful to confirm and crystallise the codes and themes. Unfortunately, only half of the participants at Case 2 consented to be contacted post-participation, and only one participant (from Case 1) responded to the summary that was sent to participants for member checking. A patient consumer (DB) contributed to the peer review workshop, however the results of this study may have been strengthened if more member checking had been achieved from participants.

5.6 Chapter summary

This chapter presented the first part of the results of a multiple-case study of two rehabilitation facilities in Victoria, including description of the physical environments and patient experiences of these environments in regard to their behaviour, emotional well-being, and safety. The results of this portion of the multiple-case study suggest a number of things that should be taken into consideration in the design of stroke rehabilitation facilities. To encourage beneficial behaviour, emotional well-being, and safety for stroke patients in inpatient rehabilitation, the physical environment should provide variety and change, ownership and control for patients, privacy but also social connection (avoid isolation), and be patient-centred in design. These qualitative findings will be revisited in Chapter 7 and merged with the

quantitative findings from this multiple-case study, which are presented in the next chapter, Chapter 6.

6 Study 3: Quantitative results of the multiple-case study

6.1 Chapter overview

This is the second of the three chapters reporting the results of Study 3. This chapter addresses research question 2: What is the nature of patients' behaviour, emotional well-being, and safety in the physical environment of current inpatient rehabilitation facilities? (see Figure 6.1 below and Section 4.3). First, the quantitative results concerning patient behaviour in the physical environment of both cases, relating to research question 2a, are reported in Section 6.2. This includes the results of the behavioural mapping (patients' location, who they were with, and their levels of physical, cognitive, and social activity throughout the day) and the results of the sleep questionnaire. Next, the quantitative results concerning patient emotional well-being (research question 2b) are reported in Section 6.3, including patients' mood (depression, anxiety, and stress), boredom, and motivation. The quantitative results concerning patient safety (research question 2c) are then reported in Section 6.4. At the end of each section, the results for the two cases are compared in a cross-case comparison. In keeping with the exploratory nature of this thesis, no comparative statistics are reported, as outlined in Section 4.10.2. The chapter ends with a discussion of the quantitative methods used. The additional materials referred to within this chapter are included in Appendices 17 to 19.

All the behaviour and emotional well-being data reported in this chapter were provided by the same participants described in the previous chapter (Section 5.3) and were collected during the same data collection periods (between September 2018 and March 2019 at Case 1, and between November 2018 and June 2019 at Case 2). All the

safety data were obtained from retrospective audits and so came from different patient cohorts and different time periods than the rest of the data in Study 3 (see methods described in Section 4.8.2.5).

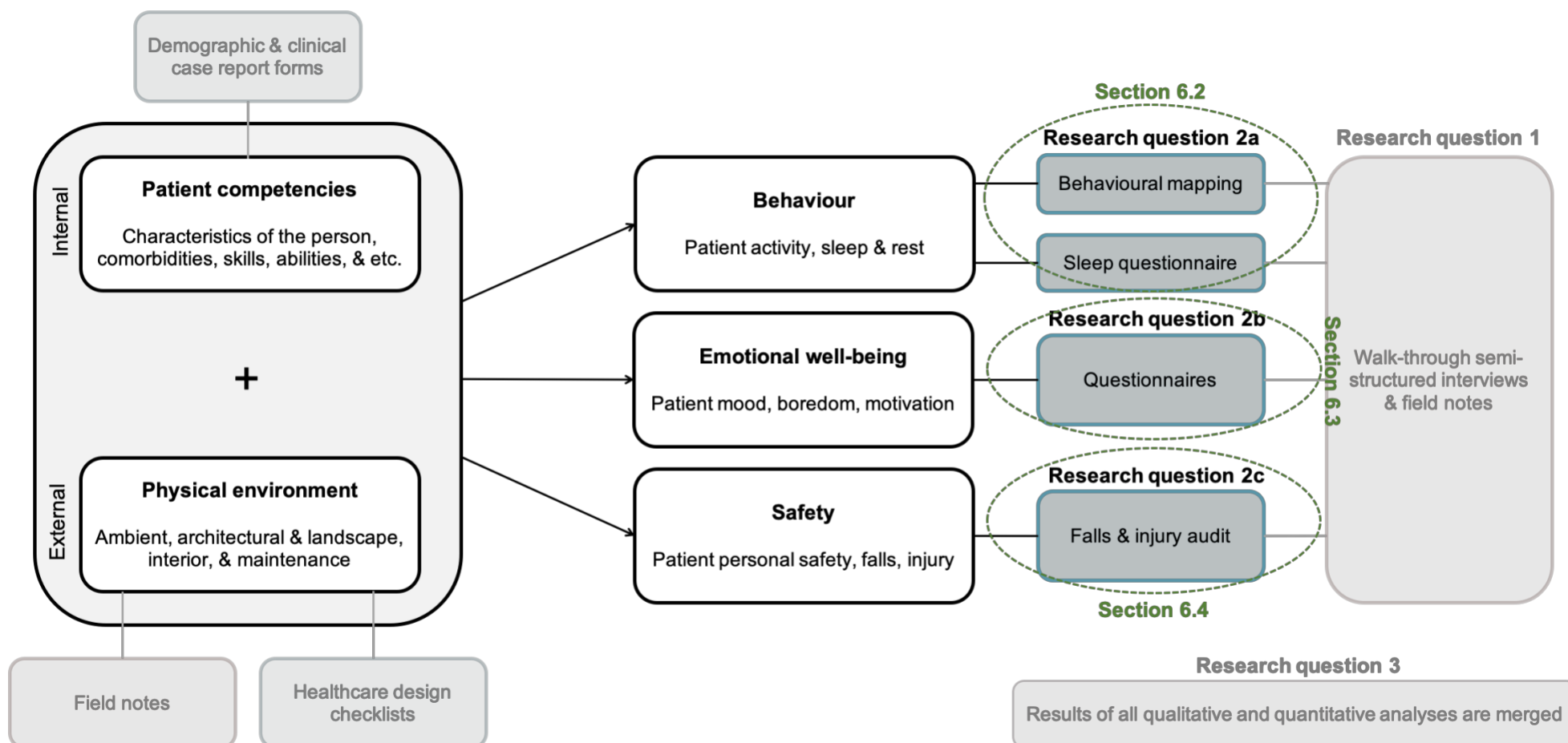


Figure 6.1 The results of Study 3 that are reported in Chapter 6.

This figure is adapted from Figure 4.2, in Chapter 4. Constructs are in white, qualitative data collection methods are in pink, quantitative measures are in blue, and mixed methods analysis is in purple. The results pertaining to research question 2 are reported in Chapter 6 and have been highlighted in the figure. The results addressing research questions 1 and 3 are reported in Chapters 5 and 7 respectively.

6.2 Patient behaviour: Behavioural mapping and sleep questionnaire

This section contains the results from the behavioural mapping observations and sleep questionnaire (Pittsburgh Sleep Quality Index [PSQI]) and addresses research question 2a to describe patients' behaviour (activity and sleep) in inpatient rehabilitation facilities (see Figure 6.1 above, methods are outlined in Section 4.8.2.3). Missing data are reported first (Section 6.2.1), followed by the results (Sections 6.2.2 and 6.2.3), and finally a cross-case comparison at the end of this section (Section 6.2.4).

Behavioural mapping was completed for all participants, resulting in 1,080 observations in Case 1 (SG, $n = 20$) and 864 observations in Case 2 (BH, $n = 16$). Behavioural mapping was conducted between 8am and 5pm in Case 1 and between 7:30am and 4:30pm in Case 2. The start times were chosen to be before to the scheduled breakfast time, i.e., the time when patients start to become active each day (breakfast was served earlier at Case 2). The sleep questionnaire was completed in full by 85% of participants in Case 1 ($n = 17$) and 81% of participants in Case 2 ($n = 13$).

6.2.1 *Missing data*

Reasons for missing behavioural mapping and sleep questionnaire data are outlined below.

6.2.1.1 *Behavioural mapping*

Participants' location and activity could be directly observed for the majority of behavioural mapping epochs; 82.6% of epochs in Case 1 ($n = 892$) and 83.3% of

epochs in Case 2 ($n = 720$). Consistent with the behavioural mapping methods described in Chapter 4, activity in unobserved epochs was estimated where possible. Most could be confidently estimated by asking the participant or a staff member (see Table 6.1) and so were classified as unobserved but not missing data. All of the epochs that were unobserved due to a door or curtain being closed or the participant being off ward could be estimated. Some of the epochs that were unobserved due to a randomly allocated observer break could not be estimated (0.7% [$n = 7$] and 0.1% [$n = 1$] of all epochs in Case 1 and 2 respectively). These were considered missing at random and so were not excluded from analysis. Some of the epochs that were unobserved due to the participant's location being unknown could not be estimated (0.6% [$n = 6$] and 0.1% [$n = 1$] of all epochs in case1 and 2 respectively). These were negligible ($< 1\%$ of all epochs) but were excluded from analysis in line with routine analysis approaches resulting in 1074 epochs in Case 1 and 863 epochs in Case 2 (Bernhardt et al., 2004).

Table 6.1 Observed and missing behavioural mapping data

Behavioural mapping	Case 1 (St George's) $n = 20$	Case 2 (Bendigo) $n = 16$
Total number of epochs, n	1080	864
Epochs observed, n (%)	892 (82.6)	720 (83.3)
Epochs not observed, n (%)	188 (17.4)	144 (16.7)
Estimated	175 (16.2)	142 (16.4)
Not estimated	13 (1.2)	2 (0.2)
Reason not observed, n (%)		
Door or curtain closed	67 (6.2)	77 (8.9)
Observer break	52 (4.8)	44 (5.1)
Participant off ward	46 (4.3)	21 (2.4)
Location unknown	23 (2.1)	2 (0.2)

6.2.1.2 *Sleep questionnaire*

Six sleep questionnaires (PSQI) were not completed in full ($n = 3$, 15% at Case 1 and $n = 3$, 18.8% at Case 2). These constitute missing data and are not included in analyses. One participant in Case 2 (BH) chose not to complete any questionnaires. This participant had experienced language changes post-stroke and felt anxious about the possibility of not understanding the questions or giving the “wrong answer”. The participant was reassured and offered the chance to complete the questionnaires with help from a speech therapist, but they declined. The participant was however happy to participate in the interview and behavioural mapping. The remaining five missing PSQIs had been completed in part, but one or more questions were left blank by participants, so a total score could not be calculated.

6.2.2 *Behavioural mapping*

This section reports the results of the behavioural mapping at both cases, including participants’ location, who they were with, and their levels of physical, cognitive, and social activity during the nine-hour observation day. In this section, participants with language and/or cognitive impairments (defined in Section 5.3.3) are compared to participants without these impairments to provide an example of how behaviours in the physical environment may vary depending on patient competencies. There were eight participants with language and/or cognitive impairments at Case 1 (40% of participants) and 12 at Case 2 (75% of participants) (see Section 5.3.3).

6.2.2.1 *Participant location in the physical environment*

Each participant’s location was recorded every 10 minutes, as described in Section 4.8.2.3. Locations were categorised as one of the following: bedroom, therapy

area, hallway (including elevators), bathroom, communal area (i.e., patient lounge on ward, community room off ward, and cafes off ward), outdoor area on hospital grounds (i.e., therapy garden, landscaped areas, or outdoor seating), or off site (i.e., tests or procedures, excursions with Occupational Therapist, or home visits), see Section 4.10.2. The majority of participants at both cases spent over 70% of observations in their bedroom: median 75% at Case 1 (IQR 69.9%, 81.5%) and 79.6% at Case 2 (IQR 70.8%, 87.5%), see Figure 6.2. This equates to a median of almost seven hours spent in the bedroom during the nine-hour observation period at both cases.

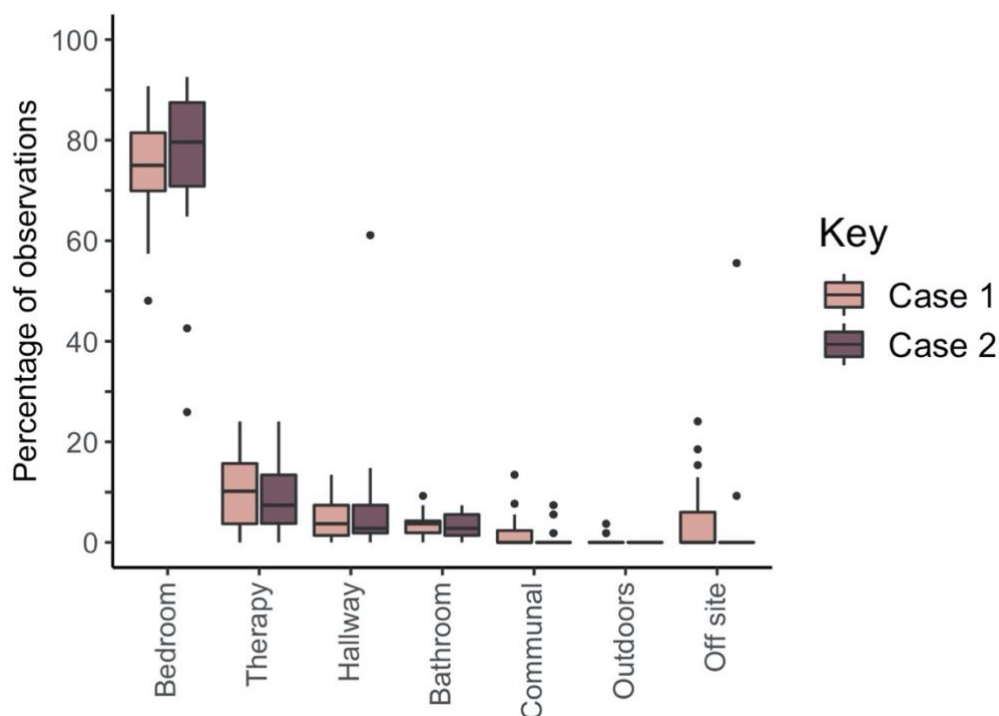


Figure 6.2 Median percentage of observations spent in each location at each case

The number of observations that participants spent in each location as a percentage of the total number of observations. Boxes indicate median and interquartile range (IQR). Dots represent outliers. Outliers are defined using the IQR rule, i.e., data points > 1.5 IQRs above the 3rd quartile or < 1.5 IQRs below the 1st quartile are considered outliers. Location categories are defined in Section 4.10.2.

Time spent in therapy was similar at both cases: median 10.2% of observations at Case 1 (IQR 3.7%, 15.7%) and 7.4% at Case 2 (IQR 3.8%, 13.4%), see Figure 6.2. Participants spent no time outdoors at Case 2, very little time outdoors at Case 1 (mean = 0.3%; median = 0%, IQR 0%, 0%), and very little time in the communal areas at either case (mean = 2.2%, median = 0%, IQR 0%, 2.4% at Case 1; mean = 0.9%, median = 0%, IQR 0%, 0% at Case 2). One participant in Case 2 spent over 60% of the day in the hallway sitting in one of the lounge nooks (see outlier in Figure 6.2). This participant shared a bedroom, was independently mobile and did not have language or cognitive deficits. One participant in Case 2 spent almost 60% of the day off site (see outlier in Figure 6.2). This participant had kidney disease and needed to go off site to receive dialysis on the observation day. The two participants who spent around 20% of the day off site in Case 1 (see outliers in Figure 6.2) were both sent to an affiliated tertiary hospital for scans during the observation day. Possible reasons for the differences between the cases in terms of where participants spent their time will be discussed in the cross-case comparison in Section 6.2.4 below.

6.2.2.1.1 Number of locations visited

Participants at both cases visited a median of 4 different locations during the day, including their bedroom (IQR 3, 4.3 at Case 1; IQR 3.8, 5 at Case 2). Figure 6.3 shows the number of unique places visited at each case (not the number of times that these locations were visited). One participant at Case 1 only went to 2 locations throughout the day (bedroom and therapy area). This participant was dependent for mobility and had cognitive and speech impairments. Two participants at Case 1 went to 6 locations throughout the day. Both of these participants were independently mobile and neither had cognitive impairments, but one had speech impairments.

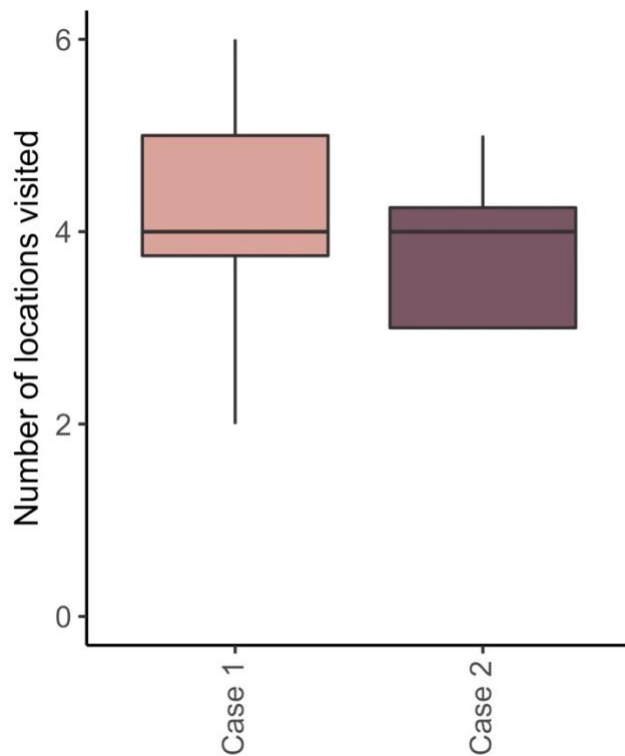


Figure 6.3 The median number of locations visited at each case

The number of different locations visited by participants at each case during the observation day. Boxes indicate median and interquartile range.

6.2.2.1.2 Participants with language and/or cognitive impairments

At both cases, the time that participants with language and/or cognitive impairments spent in each of the locations was similar to the time spent in these spaces by all participants. Participants with language and/or cognitive impairments spent a median of 73.1% of observations in the bedroom at Case 1 (IQR 67.3%, 76.4%, $n = 8$) and 79.6% in the bedroom at Case 2 (IQR 73.6%, 87.5%, $n = 12$); 10.2% of observations in therapy areas at Case 1 (IQR 5.8%, 17.8%, $n = 8$) and 7.4% in therapy areas at Case 2 (IQR 3.8%, 13.4%, $n = 12$). Time in hallways, bathroom, communal areas, outdoors, and off site were also similar for participants with and without language and/or cognitive impairments.

6.2.2.2 *Time spent alone*

Participants at Case 1 (SG) were alone for a median of 38% of observations (IQR 16.7%, 59.3%) and participants at Case 2 (BH) were alone for a median of 34.3% of observations (IQR 19.3%, 37.5%). At both cases, participants with language and/or cognitive impairments appeared to spend more time alone than participants without these impairments, see Figure 6.4. This difference appeared to be more pronounced at Case 1 (with impairments: median = 50%, IQR 38.6%, 63.4%, $n = 8$; without impairments: median = 28.3%, IQR 16.7%, 46.8%, $n = 12$) than at Case 2 (with impairments: median = 34.3%, IQR 27.4%, 37.5%, $n = 12$; without impairments: median = 23.1%, IQR 11.1%, 37%, $n = 4$). The two outliers in Figure 6.4 (both with cognitive and/or language impairments) were both in a four-bed room.

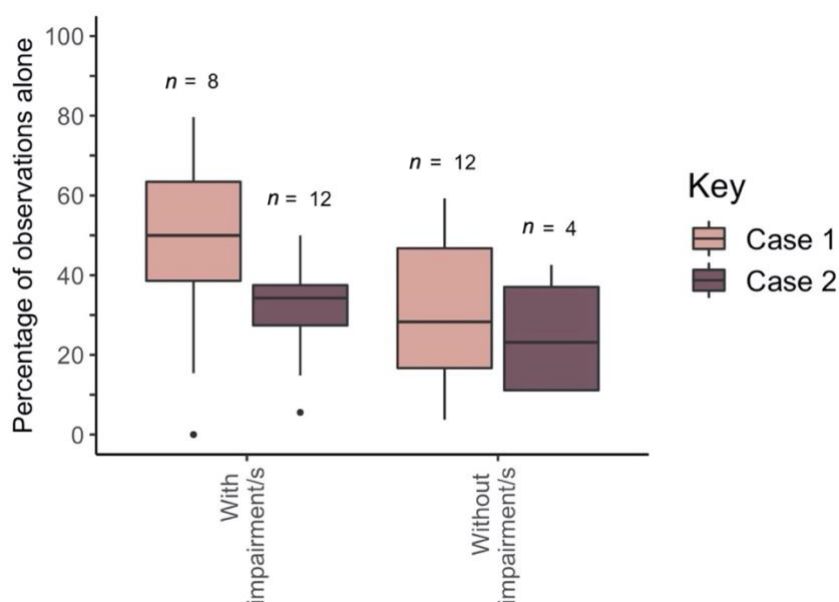


Figure 6.4 Median percentage of observations spent alone for patients with and without language and/or cognitive impairments at each case

The number of observations that participants with language and/or cognitive impairments were alone as a percentage of the total number of observations, compared to participants with no language and/or cognitive impairments. Boxes indicate median and interquartile range. Dots represent outliers. With impairments = participants with language and/or cognitive impairments. Without impairments = participants without language or cognitive impairments.

6.2.2.2.1 Time spent with others

When participants were not alone, their companion/s were recorded as one of the following: doctors, nurses, therapists (allied health), other patients, visitors, and/or others (see Section 4.8.2.3). Since participants spent most time in the bedrooms, therapy areas, and hallways (see Figure 6.2), further detail is warranted regarding who participants were with while they were in these locations. Figure 6.5 shows the median number of observations spent alone and with other people in the bedroom, at each case. The results depicted in this figure will be explored in Section 6.2.4.6.

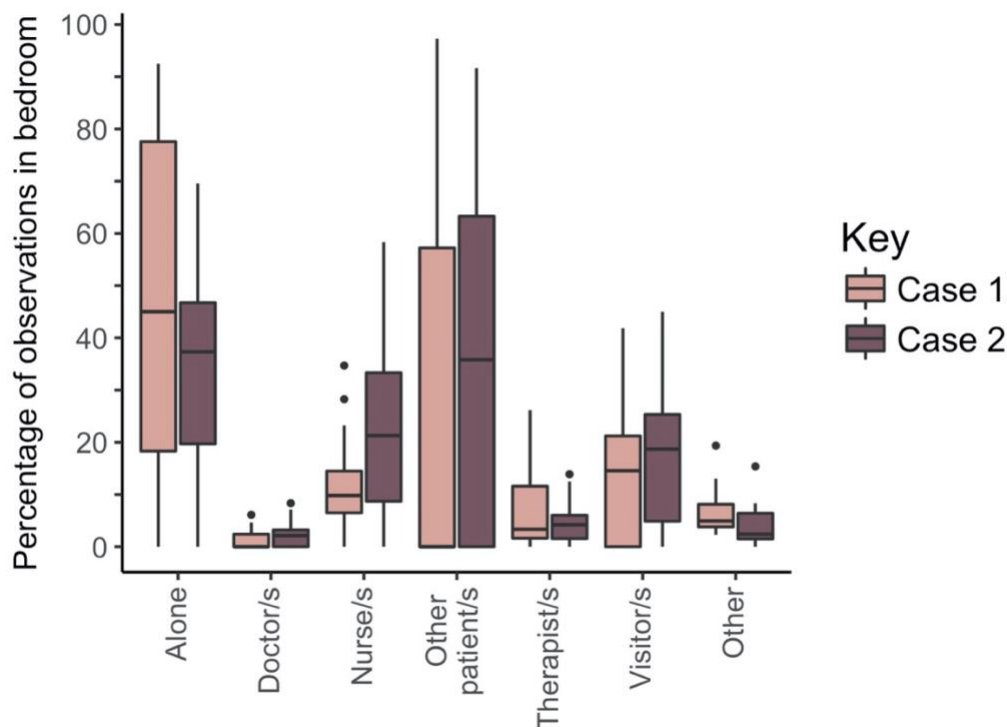


Figure 6.5 Median percentage of observations in the bedroom at each case spent alone and with other people

The number of observations that participants were alone or with other people as a percentage of the total number of observations that they were in the bedroom. At some observations, participants were with more than one type of person (e.g., participant observed with two nurses and a fellow patient in the bedroom). Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

6.2.2.2.2 Time spent alone in single and shared bedrooms

The time spent alone in the bedroom was further interrogated by considering single and shared bedrooms at each case. Figure 6.6 shows the median number of observations that participants in single and shared bedrooms spent alone while they were in their bedroom. At both cases, participants in single-bed rooms appeared to spend more time alone than those in shared bedrooms, but the difference between single and shared bedrooms appeared to be less pronounced at Case 2 compared to

Case 1 (see Figure 6.6). Possible explanations for this will be explored in the cross-case comparison in Section 6.2.4.

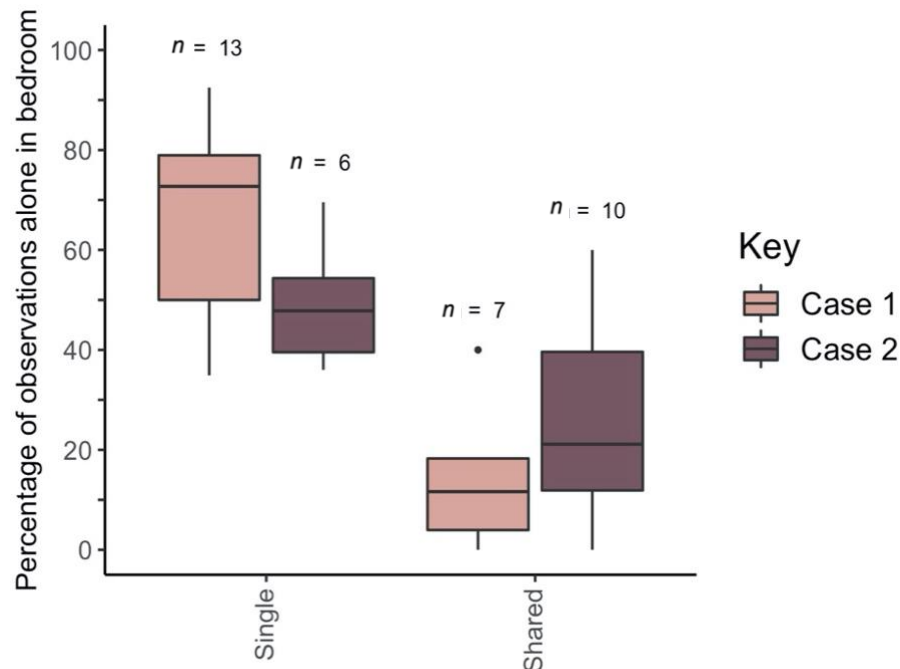


Figure 6.6 Median percentage of observations spent alone in single and shared bedrooms by all participants at each case

The number of observations that participants were alone as a percentage of the total number of observations that they spent in their bedroom. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

6.2.2.2.3 Time spent alone by participants with language and/or cognitive impairments

At both cases, participants with language and/or cognitive impairments appeared to spend more time alone in a single-bed room than in a shared bedroom, but participants without these impairments appeared to spend a similar time alone regardless of whether they were in a single or shared bedroom (see Appendix 17).

6.2.2.2.4 Time spent alone in therapy areas and hallways

Figure 6.7 and Figure 6.8 show the median number of observations spent alone and with other people in the therapy areas and hallways, respectively. The types of people present in therapy areas were similar for both cases. In the hallways, participants at Case 2 appeared to be more likely to be alone or with visitors but less likely to be with other patients compared to Case 1. Possible reasons for this will be addressed in the cross-case comparison (Section 6.2.4).

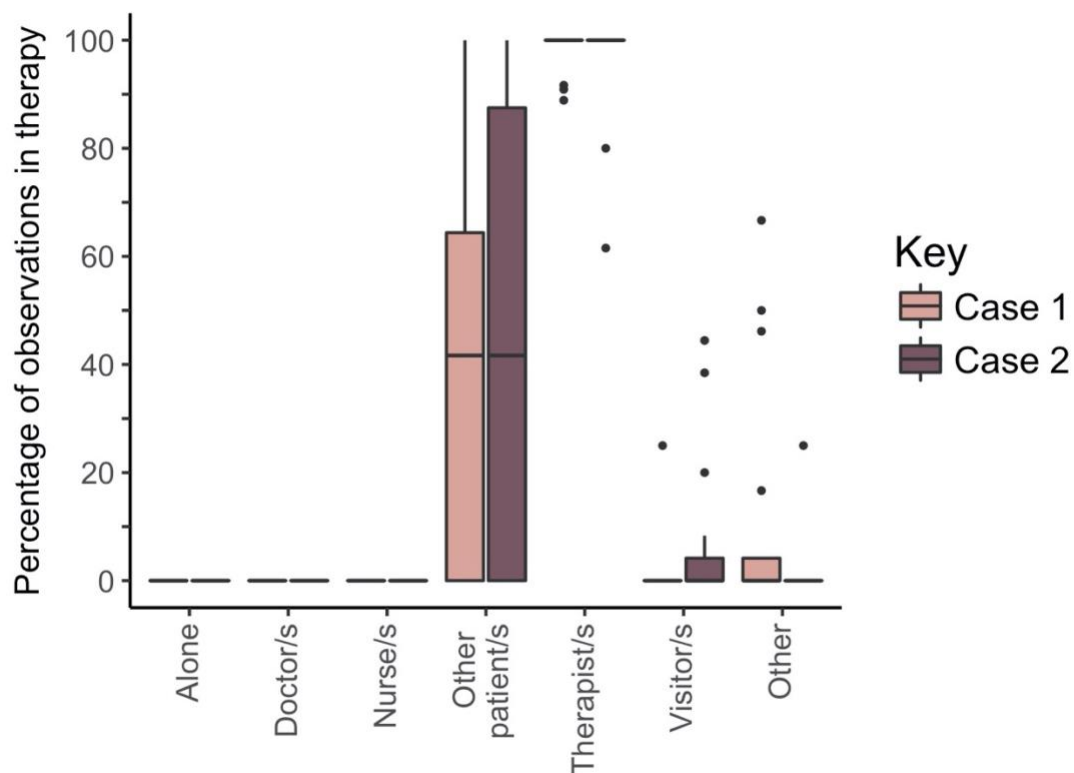


Figure 6.7 Median percentage of observations in the therapy areas at each case spent alone and with other people

The number of observations that participants were alone or with other people as a percentage of the total number of observations that they were in the therapy areas. At some observations, participants were with more than one type of person (e.g., participant observed with two therapists and three patients together in the gym). Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

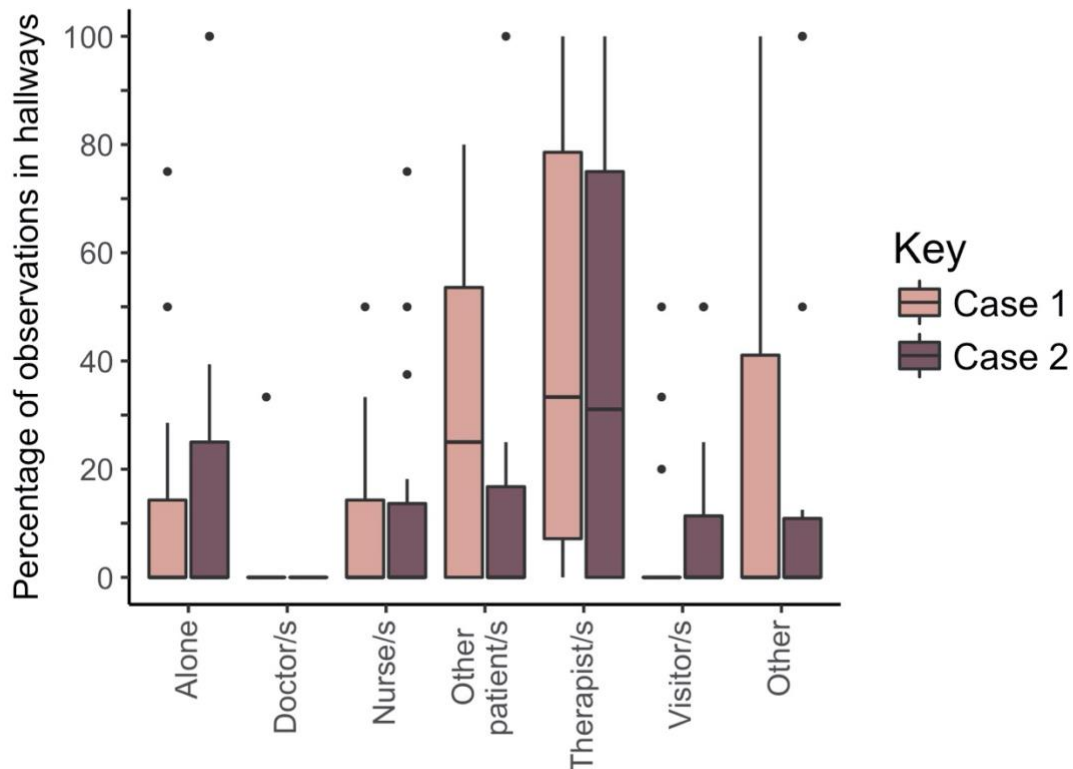


Figure 6.8 Median percentage of observations in the hallway at each case spent alone and with other people

The number of observations that participants were alone or with other people as a percentage of the total number of observations that they were in the hallway. At some observations, participants were with more than one type of person (e.g., participant observed with two nurses and a fellow patient together in the hallway). Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

6.2.2.3 Participants' activity in the physical environment

Participants were completely inactive for a median of almost a quarter of the nine-hour observation period at Case 1 (median = 22.2% [2 hours], IQR 12.9%, 37.5%) and a third of the time at Case 2 (median = 34.3% [3.1 hours], IQR 18.1%, 14.3%). Participants were considered inactive if they were not participating in any

physical, cognitive, or social activity, as defined in Section 4.8.2.3. For example, a participant sitting in a chair, not moving, and not interacting with another person or the environment would be considered inactive. Participants spent more time inactive in some locations than in other locations (see Figure 6.9). Participants were inactive for a median of 32% of the time that they were in their bedroom at Case 1 (IQR 18.9%, 37.4%) and 42.1% of the time that they were in their bedroom at Case 2 (IQR 21.9%, 50%). Although participants were in their bedroom for three-quarters of the observations at both cases (see Section 6.2.2), the bedroom accounted for 96.3% and 89.9% of the total amount of inactivity in Case 1 and Case 2 respectively. Time asleep was included in the category of ‘inactivity’. Participants were asleep for more observations at Case 1 compared to Case 2 (Case 1: median = 9.4% [0.8 hours], IQR 3.2%, 15.7%; Case 2: median = 7.4% [0.7 hours], IQR 3.7%, 12%).

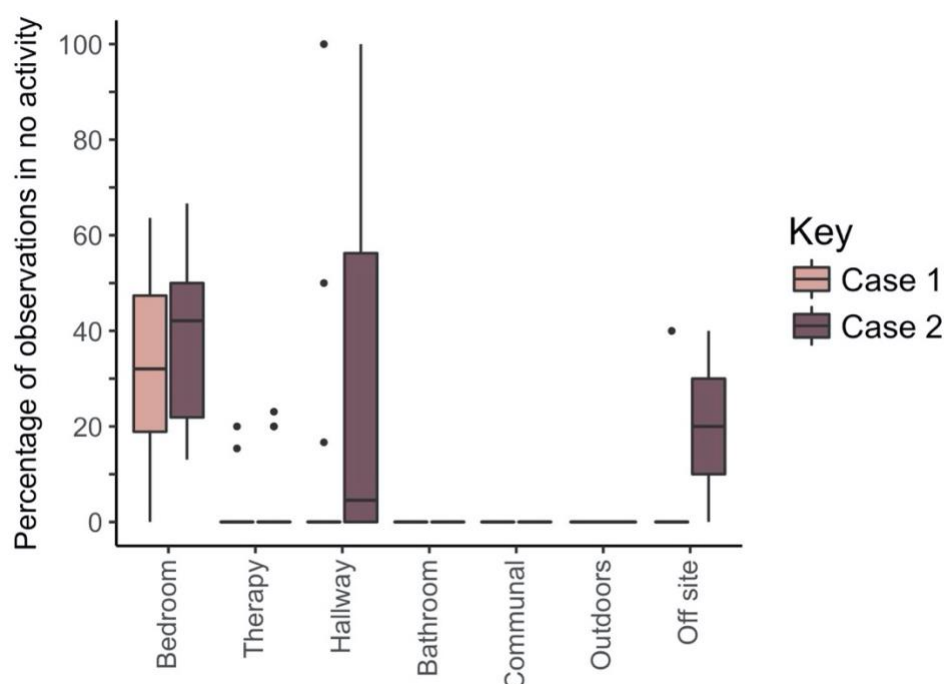


Figure 6.9 Median percentage of observations spent inactive in each location at each case

The number of observations that participants spent inactive (no physical, cognitive, and/or social activity as defined in 4.8.2.3) as a percentage of total observations in each location. Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

Overall, participants at Case 1 appeared to spend more time in physical activity than participants in Case 2 (mean = 53.2%, median = 50%, IQR 38%, 67.6% for Case 1; mean = 37.9%, median = 37%, IQR 27.3%, 44% for Case 2). Participants at Case 1 also appeared to spend more time in cognitive activity (mean = 18.2%, median = 14.8%, IQR 8.33%, 26.4% for Case 1; mean = 6.7%, median = 2.8%, IQR 0%, 13.4% for Case 2) than participants in Case 2, but the proportion of time spent in social activity was similar in both cases (mean = 37.4%, median = 40.7%, IQR 23.6%, 48.6% for Case 1; mean = 36.5%, median = 30.6%, IQR 25.9%, 43.1% for Case 2).

Figure 6.10 shows the amount of time spent in physical, cognitive, and social activity as a proportion of the total amount of time spent in each location at each case. At both cases, most activity occurred outside the bedroom, particularly in bathrooms, communal areas, therapy areas, and hallways, but participants spent very little time at these locations, as depicted in Figure 6.2. The pattern of social activity in the bedrooms was similar between cases, but there appeared to be slightly more physical and cognitive activity in the bedrooms in Case 1 compared to Case 2. The pattern of activity in the therapy areas differed between the cases; there appeared to be more physical, cognitive, and social activity in Case 1 compared to Case 2. The pattern of activity in the hallways differed between the cases, with apparently more physical and social activity in Case 1 compared to Case 2. These differences will be discussed in the cross-case comparison in Section 6.2.4.

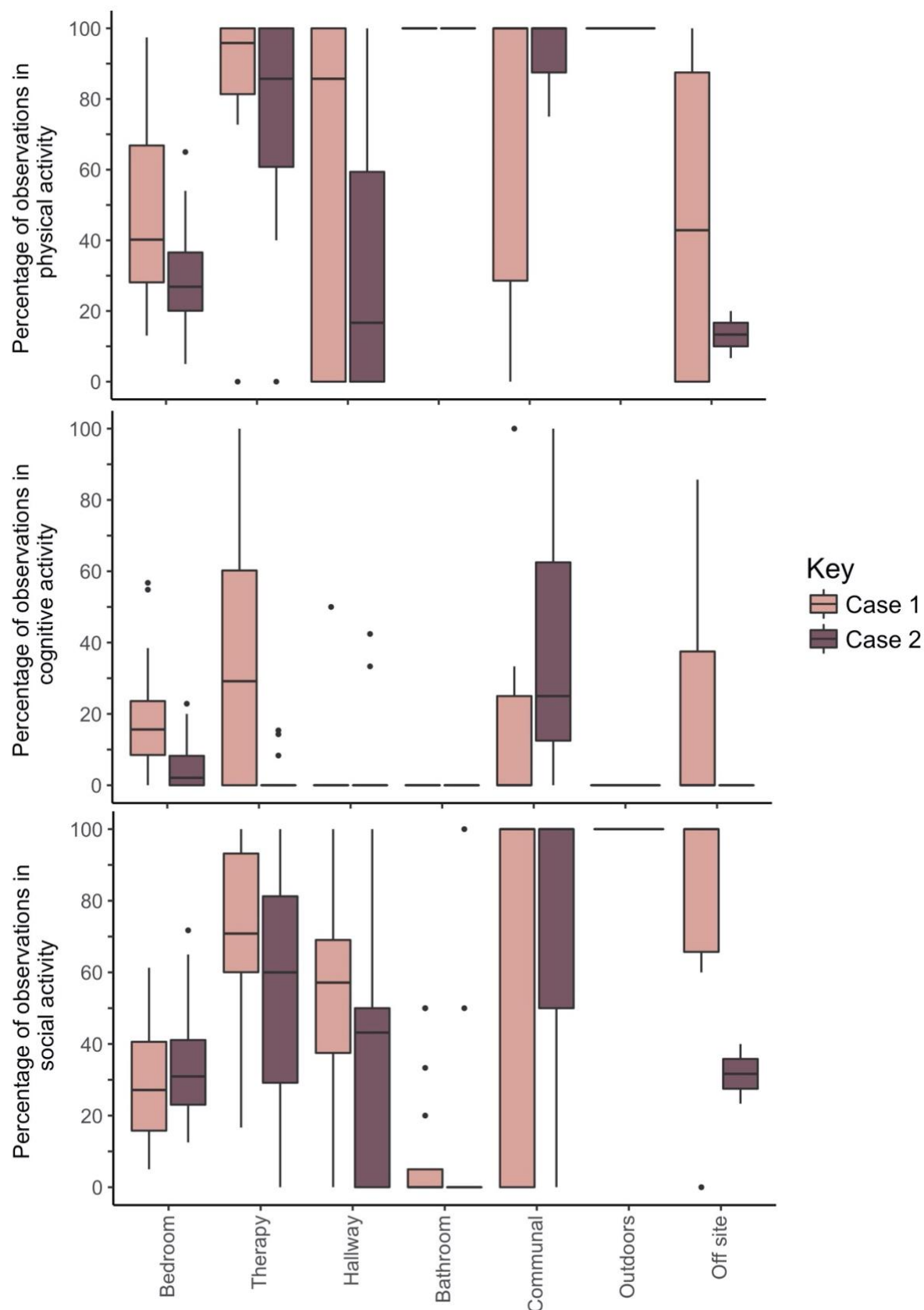


Figure 6.10 Median percentage of observations in physical, cognitive, and social activity in each location at each case.

The number of observations that participants spent in physical, cognitive, and social activity (as defined in 4.8.2.3) as a percentage of total observations in each location. Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

6.2.2.3.1 Participants' activity in single and shared bedrooms

Figure 6.11 shows the percentage of observations that participants in single and shared bedrooms spent in social activity at each case. At Case 1, participants in single-bed rooms appeared to spend slightly less time in social activity than participants in shared bedrooms (single-bed rooms: median = 19.4%, IQR 12.2%, 46.5%, $n = 13$; shared bedrooms: median = 27.3%, IQR 25.5%, 37%, $n = 7$), which reflected the time spent alone in single and shared bedrooms at this case (see Figure 6.6). Conversely, at Case 2, participants in single-bed rooms appeared to spend more time in social activity than participants in shared bedrooms (single-bed rooms: median = 50.8%, IQR 41.1%, 62.8%, $n = 6$; shared bedrooms: median = 23.2%, IQR 22.9%, 29.8%, $n = 10$), which is somewhat unexpected since participants in single-bed rooms at this case appeared to spend more time alone than participants in shared bedrooms (see Figure 6.6). This will be interrogated further in the cross-case comparison in Section 6.2.4 by considering the amount of time that participants were socially active in the bedroom as a percentage of the total amount of time that they were with other people in these spaces.

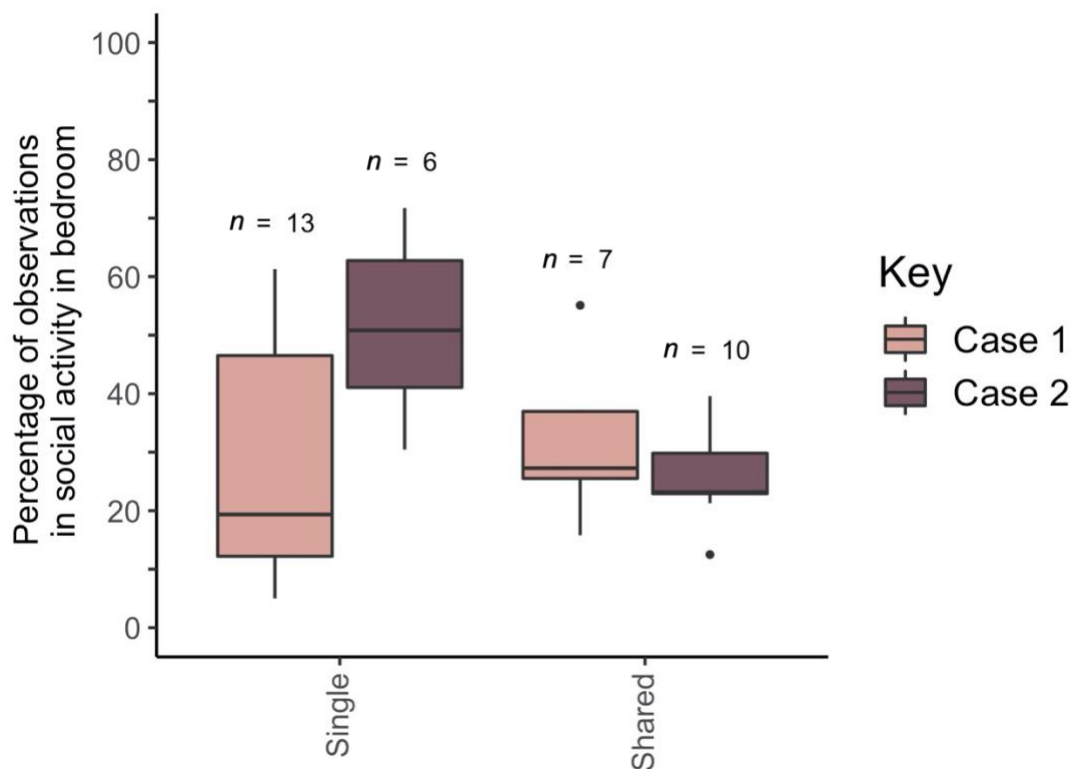


Figure 6.11 Median percentage of observations spent in social activity single and shared bedrooms by all participants at each case

The number of observations that participants were alone as a percentage of the total number of observations that they spent in their bedroom. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

6.2.2.3.2 Activity completed by participants with language and/or cognitive impairments

At Case 1, participants with language and/or cognitive impairments appeared to spend less time inactive overall than participants without these impairments, but the opposite was true at Case 2 (see Table 6.2). Similarly, at Case 1, participants with language and/or cognitive impairments appeared to spend more time in physical, cognitive, and social activity overall than participants without these impairments, but

again the opposite was true at Case 2 (see Table 6.2). The majority of the additional physical activity undertaken by participants with language and/or cognitive impairments at Case 1 occurred in the bedroom (see Appendix 18). The additional cognitive and social activity completed by participants with language and/or cognitive impairments at Case 1 occurred in the bedroom, therapy areas, and communal areas (see Appendix 18).

Table 6.2 The percentage of observations that participants with and without language and cognitive impairments spent in physical, cognitive, and social activity at each case

Activity category	Case 1 (St George's)		Case 2 (Bendigo)	
	<i>n</i> = 20		<i>n</i> = 16	
	Impairment <i>n</i> = 8	Without <i>n</i> = 12	Impairment <i>n</i> = 12	Without <i>n</i> = 4
Inactive, median (IQR)	12.3 (2.8, 27.3)	31.5 (19.1, 37.5)	38.9 (18.5, 44.7)	22.2 (12.5, 32.4)
Active, median (IQR)				
Physical activity	68.3 (59.7, 80.1)	44.4 (35.2, 51.9)	34.3 (25.5, 41.2)	43.5 (36.1, 50)
Cognitive activity	32.1 (18.1, 37.9)	9.3 (5.6, 16.2)	2.78 (0, 13.9)	3.7 (0, 9.3)
Social activity	37.0 (23.6, 44.7)	41.7 (26.4, 51.9)	28.7 (25.1, 41.7)	36.1 (30.6, 48.1)

Impairment = participants with language and/or cognitive impairments; Without = participants without language and/or cognitive impairments.
IQR = interquartile range

6.2.3 *Sleep questionnaire*

The PSQI was used to measure sleep quality (see Section 4.8.2.3). This questionnaire was completed by 17 participants in Case 1 and 13 participants in Case 2 (see Section 6.2.1.2). The PSQI has a minimum score of 0 and a maximum score of

21. Lower scores indicate better sleep quality and any score above 5 is associated with poor sleep quality (Buysse et al., 1989). Patient-reported sleep quality was similarly poor at both case studies (see Table 6.3). At both cases, participants in single-bed rooms appeared to report slightly worse sleep quality than participants in shared bedrooms (see Table 6.3).

Table 6.3 Patient-reported sleep quality in single and shared bedrooms

PSQI	Case 1 (St George's) <i>n</i> = 20	Case 2 (Bendigo) <i>n</i> = 16
PSQI completed	<i>n</i> = 17	<i>n</i> = 13
PSQI, median (IQR, range)	10 (5, 1-15)	10 (6, 2-15)
Participants in single	10 (5, 1-15), <i>n</i> = 11	11 (3, 8-14), <i>n</i> = 5
Participants in shared	9 (7.75, 3-15), <i>n</i> = 6	7.5 (8.75, 2-15), <i>n</i> = 8

Single = single-bed room, shared = shared bedroom. Acronyms: PSQI = Pittsburgh Sleep Quality Index, IQR = interquartile range. Lower PSQI scores indicate better sleep quality.

6.2.4 **Cross-case comparison**

The above results highlight some similarities and differences in patient behaviour between the two cases. These similarities and differences are explored in more detail in this section and examined in light of past research.

6.2.4.1 *Time spent in the bedroom*

Participants at both cases spent the vast majority of the day in their bedroom, almost never went outside, and visited few locations throughout the day. This is similar to what has been reported in previous studies of stroke rehabilitation patient activity, which have found that patients were in their bedroom for between 62% and 88.9% of the day (Anåker et al., 2018; King et al., 2011; McRae, Bew, Smith, & Mudge, 2020; Selenitsch & Gill, 2019).

Participants at both cases, and especially at Case 2 (BH), were inactive for the majority of the time that they were in their bedrooms. The time inactive and alone in the bedrooms was disproportionate to the total time spent in the bedroom at both cases. That is, participants at both cases were more inactive in the bedroom than they were in other locations. This suggests that patient activity could perhaps be increased if patients spent more time in other areas of the facility instead of their bedroom.

6.2.4.2 More physical and cognitive activity at Case 1

Participants at Case 1 (SG) appeared to spend more time in physical and cognitive activity overall, and less time in their bedrooms than participants at Case 2 (BH) (see Figure 6.2 and Figure 6.10). The participants at Case 2 were more unwell than those at Case 1 (see Table 5.5, page 132), which could partly explain why they participated in less activity.

Clinical status may not be the only reason for reduced activity at Case 2 (BH). Indeed, participants at this case were not more likely to be mobility impaired (see Section 5.3.3) and actually appeared to spend less time asleep during the day than at Case 1 (see Section 6.2.2.3). It is therefore worth considering how the physical environment may have contributed to the lower activity levels at Case 2. The physical environment of the bedroom was different between the cases. For example, compared to Case 1 (SG), the bedrooms at Case 2 (BH) were more modern, with big windows and expansive views (see Section 5.2). It is possible that this apparently pleasant environment encouraged participants at Case 2 to spend more time inactive in their bedrooms.

Another explanation is that the physical environment at Case 1 (SG) may be particularly conducive to activity compared to other hospitals, while Case 2 (BH) was on par with most other hospitals. Participants at Case 1 (SG) appeared to participate in

more physical and cognitive activity than patients in a previous study who were exposed to an environmental enrichment intervention that was specifically designed to increase their activity: Physical activity Case 1 = 53.2%, Case 2 = 37.9, environmental enrichment intervention = 31%; Cognitive activity Case 1 = 18.2%, Case 2 = 6.7%, environmental enrichment intervention = 13% (Janssen et al., 2014b). These results are particularly surprising considering that the participants in the present study had more severe strokes and were more cognitively impaired than the patients in the environmental enrichment study: mean NIHSS Case 1 = 5, Case 2 = 7, environmental enrichment intervention = 3; mean MoCA Case 1 = 21.5, Case 2 = 19, environmental enrichment intervention = 16 (Janssen et al., 2014b). Further analysis could be performed on the data collected in this study to determine the type of physical and/or cognitive activities performed at Case 1 (SG) (e.g., walking, reaching, reading, etc.), and whether these differed from the type of activities performed at Case 2 (BH), or the type of activities performed at a facility set up as an enriched environment. Understanding the type of activities that were performed may help to identify whether there is some aspect of the physical environment at Case 1(SG) that was naturally conducive to physical and cognitive activity.

6.2.4.3 *The availability and dimensions of therapy areas*

Participants spent a median of 55 minutes in therapy areas at Case 1 (SG) and 40 minutes at Case 2 (BH), which is within the global averages for time in therapy (see Section 1.2.3). Participants at Case 1 (SG) appeared to spend more time in physical and cognitive activity while in these therapy areas compared to Case 2 (BH) (see Figure 6.10). There were a similar number of other patients and therapists present in the therapy areas at both cases (see Figure 6.7), but the gym was much smaller at Case 2 (BH) (see Section 5.2). The gym at Case 2 (BH) would therefore have been

more crowded than at Case 1 (SG). It is possible that practice in therapy may have been influenced by this crowding leading to less activity in the therapy areas at Case 2 compared to Case 1 (see Figure 6.10).

The availability of Occupational Therapy spaces at Case 1 (SG) could explain the comparatively higher levels of cognitive activity recorded in the therapy areas at this case. There were two Occupational Therapy areas at Case 1 (SG) (a therapy room and a kitchen), but no dedicated Occupational Therapy spaces at Case 2 (BH). Because of the lack of Occupational Therapy spaces at Case 2 (BH), cognitive therapies were either conducted at the bedside (classified as ‘bedroom’ on the behavioural mapping data collection sheet) or in the community room (classified as a ‘communal area’) (see Section 5.2), which likely accounts for the higher cognitive activity in the communal areas at Case 2 (BH) (see Figure 6.10). A qualitative study of Occupational Therapists’ clinical decision making in stroke rehabilitation found that their intervention choices were influenced by their treatment environments and equipment availability, with the more involved therapies occurring in the therapy areas as opposed to the bedside (Skubik-Peplaski, 2015). This further supports the notion that the lack of therapy spaces at Case 2 (BH) may have played a role in the lower cognitive activity at this case. Having said this, participants at Case 2 (BH) were generally more cognitively impaired than those at Case 1 (SG) (see Table 5.5) which could also have played a role in their reduced cognitive activity.

Previous studies have suggested that an increased distance between the ward and the gym may lead to a decrease in patients’ physical activity because the longer journey necessitates the use of a wheelchair (Blennerhassett et al., 2018), however, other studies have found no difference in physical activity between facilities with large or small distances between wards and therapy areas (Mackey et al., 1996). Our

results suggest that it is not just the relative position of therapy spaces that is important, but also that the size and very existence of these spaces may impact patients' levels of physical and cognitive activity. Future studies could investigate the impact of crowding in the gym on patients' physical activity, and of the availability of dedicated Occupational Therapy spaces on patients' cognitive activity.

6.2.4.4 *The location and accessibility of outdoor and communal areas*

Outdoor areas and indoor communal spaces were very rarely used at either case, but participants at Case 1 (SG) appeared to spend slightly more time in these spaces than participants at Case 2 (BH) (see Figure 6.2). The underuse of these spaces is a concern since the importance of outdoor and communal spaces has been emphasised in previous studies (Killington et al., 2019), and in the qualitative results of this present study (see Section 5.4). The apparently higher use of these spaces at Case 1 (SG) could have been because the ward was closer to the ground floor than at Case 2 (BH) and so the cafes and outdoor areas were slightly more accessible (see Section 5.2), or it could again reflect the different patient cohorts.

6.2.4.5 *The use of hallways*

Although participants at Case 2 (BH) appeared to spend less time alone overall than participants at Case 1 (SG), the opposite pattern occurred in the hallways (see Figure 6.8). Participants at Case 2 (BH) appeared to be more likely to be alone or with visitors when in the hallways, less likely to be with other patients, and less likely to be in physical or social activity in the hallways compared to Case 1 (SG). An explanation for these findings could be the way in which the lounge nooks were used in Case 2 (BH) (see photograph A12.18 in Appendix 12 and floor plan 2 in Appendix 13). The lounge nooks were classified as part of the 'hallway' on the behavioural

mapping data collection form, but the behavioural mapping results suggest that these spaces were used in quite a different way from other parts of the hallway – as a place to go alone or with family, and a place for inactivity and rest.

6.2.4.6 *Time alone in the bedrooms*

The patterns in Figure 6.4 indicate that time alone varied depending on both impairment type (participants with language or cognitive impairments spent more time alone) and case (participants at Case 1 spent more time alone). It therefore appears that participants' behaviour at both cases may have been influenced by both internal factors (patient competencies) and external factors (some aspect/s of the social and/or physical environment of the cases).

Although participants at Case 1 (SG) appeared to spend more time in physical and cognitive activity and less time in their bedrooms overall, participants at Case 2 (BH) appeared to spend less time alone and the amount of social activity was similar between cases. Nurses and other patients appeared to be more present in the bedrooms in Case 2 (BH) compared to Case 1 (SG) (see Figure 6.5). The presence of other patients in bedrooms at Case 2 (BH) could perhaps be explained by the higher percentage of shared bedrooms allocated to participants at this case (see Table 5.6, page 136). The presence of nurses in the bedrooms at Case 2 may have been due to the more unwell clinical cohort at Case 2 (see Table 5.5, page 132), the slightly higher nurse to patient ratio (see Table 5.1, page 121), or due to position of the bedroom relative to communal hubs – there were multiple nurses' stations in close proximity to the bedrooms at Case 2 (BH), while some of the bedrooms at Case 1 (SG) were more isolated (see Section 5.2 and floor plans, Appendix 13).

Participants with language and/or cognitive impairments appeared to spend more time alone than participants without these impairments at both cases, but the

difference between people with and without these impairments was more pronounced at Case 1 (SG) than at Case 2 (BH) (see Figure 6.4). One interpretation of this finding could be that having a language and/or cognitive impairment was more of a cause of isolation at Case 1 (SG) than it was at Case 2 (BH). This may have been due to more participants being in a single-bed room at Case 1 (SG), or due to the isolated location of some of the bedrooms, as mentioned above. Design choices such as decentralised nursing stations, or a hybrid model with central meeting rooms in addition to decentralised stations, may therefore be especially important for patients with language and/or cognitive changes (Smith & Macdonald, 2015). Nurses on units with decentralised stations may spend less time on administrative tasks, leaving more time to spend with patients (Pati, Harvey, Redden, Summers, & Pati, 2015; Zborowsky, Bunker-Hellmich, Morelli, & O'Neill, 2010).

As would be expected, participants in shared bedrooms appeared to spend less time alone than participants in single-bed rooms at both cases, but this effect was less pronounced at Case 2 (BH) compared to Case 1 (SG) (see Figure 6.6). One reason for the smaller difference between amount of time alone in single and shared bedrooms at Case 1(SG) could be that all of the participants who were in a shared room at this case were in a three- or four-bed room, and so would not have been left alone if one roommate was absent, while many of the participants who were in a shared bedroom at Case 2 (BH) were in a two-bed room and so would have been alone if their one roommate was absent (see Table 5.6).

In addition, the participants at Case 2 (BH) may have been more likely to have been categorised as alone in their bedroom, even when a roommate was present. As outlined in Section 4.8.2.3, a participant was considered 'alone' if there were no other people in the vicinity capable of social interaction. People who were asleep, severely

cognitively impaired, or behind a curtain were therefore not included. Some of the participants at Case 2 (BH) shared a room with patients who had been admitted under a different classification, i.e., for complex medical care rather than for rehabilitation (see Section 5.2). Participants sharing a room with one of these patients would have been classified as ‘alone’ if their roommate was asleep or too cognitively impaired to communicate. What is more, field notes indicate that the retractable dividing curtains were often closed between the beds in the shared bedrooms at Case 2 (BH), which also would have resulted in a participant being categorised as ‘alone’. The dividing curtains were more substantial and easier to use at Case 2 (BH) compared to the curtains at Case 1 (SG). These results suggest that there are many variables in the physical environment of the bedroom which may influence how much time patients spend in there alone, including number of beds, roommates’ impairments, type of barriers/curtains between beds, and position relative to communal hubs, to name a few.

6.2.4.7 *Social activity in single and shared bedrooms*

At Case 1 (SG), participants in single-bed rooms were socially active for 71% of the time that another person was present and participants in shared bedrooms were socially active for 31% of the time that another person was present. At Case 2 (BH), participants in single-bed rooms were socially active for 96% of the time that another person was present and participants in shared bedrooms were socially active for 29% of the time that another person was present. In other words, at both cases, the time that participants spent with others appeared to be more ‘productive’ (i.e., resulted in more social activity) in single-bed rooms than in shared bedrooms. This makes sense as other people would normally only enter a single-bed room in order to interact with

the participant in some way, whereas other people may be present in a shared bedroom with no need to interact with the participant.

This effect (i.e., more social activity when other people present in single compared to shared bedrooms) appeared to be much stronger at Case 2 (BH) compared to Case 1 (SG). The single-bed rooms at Case 2 (BH) were particularly productive for social activity (i.e., social activity occurred almost the whole time that someone else was present) and the shared bedrooms were particularly unproductive (i.e., social activity occurred for a very small percentage of the time that other people were present). The difference in the ‘productivity’ of single and shared bedrooms at Case 2 (BH) may help to explain why there was more social activity in single-bed rooms compared to shared bedrooms at this case (see Figure 6.11). The beds in the shared bedrooms at Case 2 (BH) were on opposite sides of the room (rather than alongside each other) and were separated by the retractable curtains mentioned above. These design features, and possibly others, were likely introduced to the shared bedrooms to foster patient privacy but they may have had the additional effect of reducing social interaction.

6.2.4.8 *Sleep in single and shared bedrooms*

At both cases, participants were asleep for a median of less than an hour during the day (see 6.2.2.3) and reported poor night-time sleep quality (see Table 6.3). Perhaps surprisingly, at both cases, participants in single-bed rooms appeared to report slightly worse sleep quality than participants in shared bedrooms. It is possible that these results are reflective of the patient cohort, rather than the number of beds in the room. Participants with language and/or cognitive impairments were more likely to be allocated a single-bed room at both cases (see Section 5.3.4). If participants who had pre-existing sleeping difficulties were also more likely to be allocated a single-

bed room, then this would explain the poorer sleep in this room type, but it is unknown whether this occurs. A recent systematic review found seven studies reporting that patients, staff, and/or family subjectively felt that single-bed rooms were more conducive to sleep, but no studies that objectively measured whether this was indeed the case (Taylor, Card, & Piatkowski, 2018). However, in one study reported in this systematic review, night-time noise disturbance was objectively measured and found to be associated with poor sleep in both single and shared bedrooms, with no difference in noise levels between the room types (Park et al., 2014). This is reflective of our qualitative results, which suggest that night-time noise disturbed participants' sleep in both single and shared bedrooms (see Section 5.4). These findings indicate that other factors, besides the number of beds in the room, are important for sleep quality in both single and shared bedrooms, and that these other factors may include the patient's clinical profile and the extent of night-time noise.

6.2.4.9 Environments for people with language and/or cognitive impairment

As mentioned above, participants with language and/or cognitive impairments appeared to spend more time alone at both cases than participants without these impairments. At Case 2 (BH), this was reflected in activity levels – participants with these impairments appeared to be less active than those without – however, the opposite was observed at Case 1 (SG). The appropriate intensity of therapy for stroke patients with cognitive impairment is currently unknown (Liu & Lou, 2018), however, there may be a level of general cognitive activity that is beneficial and promoting cognitive activity is a core component of environmental enrichment (see Section 1.4.2) so it is a concern that participants with these impairments at Case 2 (BH) may be less active. The apparently lower levels of social activity in participants with language and/or cognitive impairments at both cases is perhaps of most concern

(see Table 6.2). It is worth noting that the time spent in social activity may not reflect the quality of that social interaction or the extent to which the participant was engaged in the communication. The physical environment may impact the quality of communication that patients with language and/or cognitive impairments experience (Stans, Dalemans, de Witte, Smeets, & Beurskens, 2017), in addition to merely influencing whether or not an interaction occurs. Previous research indicates that the extent of patients' re-engagement with social participation may be mediated by the perceived quality of social support that they receive (rather than the quantity) (Foley, Nicholas, Baum, & Connor, 2019). The quality of patients' social interaction in rehabilitation may therefore have implications for their participation in social activities post-discharge.

Given the relatively small sample size in this study, it is possible that this difference apparent in activity between the cases was more related to variation in participants' clinical and demographic characteristics than to environmental influences. The results of the MoCA (measure of cognitive impairment) suggest that participants at Case 2 (BH) were more cognitively impaired than those at Case 1 (SG) (see Table 5.5, page 132). Participants at Case 1 (SG) may also have experienced different types of language and/or cognitive impairments compared to participants at Case 2 (BH), resulting in different levels of activity. Unfortunately, the clinical measures used in this study cannot provide this level of detail. This will be addressed as a limitation in Section 6.5.1 below.

6.2.4.10 Heterogeneity of environment and behaviour

In general, behaviour varied more between participants at Case 1 (SG) than between participants at Case 2 (BH). That is, there was wider variation in how much time participants spent alone and how much activity they completed at Case 1 (SG),

compared to Case 2 (BH) (see for example the IQRs in Figure 6.5 and Figure 6.10). There were slightly more participants at Case 1 (SG), which should result in less variation, rather than more. Participants at Case 1 (SG) did not appear to be more heterogeneous in their clinical characteristics than participants at Case 2 (BH) (see Table 5.5, page 132), so this is unlikely to explain the wider spread in behaviours. The heterogeneity of the physical environment at Case 1 (SG) may be a possible explanation for the heterogeneity of behaviours at this case. The bedrooms in Case 1 (SG) varied considerably in terms of dimensions, outlook, when they were built, distance from communal hubs (e.g., nurses' station), and number of beds in the room (see Section 5.2, Table 5.1, and floor plans in Appendix 13). Indeed, participants who changed bedrooms during their admission noted in their interviews the difference in terms of privacy, isolation, and access to facilities (see for example see Section 5.4.2.3, sub-theme 3.1 cont.). The bedrooms in Case 2 (BH), by comparison, were relatively standardised and similar to each other (see Section 5.2, Table 5.1, and floor plans in Appendix 13). These findings suggest that a heterogeneous environment may lead to heterogeneous behaviours.

6.3 Patient emotional well-being: Mood, boredom, and motivation questionnaires

This section contains the results from the questionnaires that were used to address research question 2b and describe patients' emotional well-being (see Figure 6.1 above, methods are outlined in Section 4.8.2.4). The questionnaires included: 1) a measure of mood (the Depression Anxiety Stress Scales [DASS]), 2) a measure of boredom (the Multidimensional State Boredom Scale [MSBS]), and 3) a Visual

Analogue Scale [VAS] to measure how motivating patients find their environment. Missing data are reported first (Section 6.3.1), followed by the results of the mood, boredom, and motivation questionnaires (Sections 6.3.2, 6.3.3, and 6.3.4 respectively), and finally a cross-case comparison to compare the results of the two cases (Section 6.3.4). In this section, as in the previous section, participants with language and/or cognitive impairments (defined in Section 5.3.3) are compared to participants without these impairments to provide an example of how emotional well-being may vary depending on patient competencies.

6.3.1 ***Missing data***

As mentioned in Section 6.2.1.2, one participant at Case 2 (BH) declined to complete any questionnaires. Reasons for all other missing data are outlined below.

6.3.1.1 ***Depression, anxiety, and stress questionnaire***

This questionnaire was completed in full by all of the participants in Case 1 ($n = 20$), and by 88% of the participants in Case 2 ($n = 14$). The second missing DASS at Case 2 was incomplete because the participant (who had language impairments) found the abstract nature of the questions very difficult to understand, despite support.

6.3.1.2 ***Boredom***

The MSBS was completed in full by 75% of participants in Case 1 ($n = 15$), and by 88% of participants in Case 2 ($n = 14$). The second missing MSBS in Case 2 was not completed by the participant who did not complete the DASS (mentioned above). The 5 incomplete MSBS questionnaires in Case 1 were all partially completed by participants, but all skipped one or more questions. The MSBS is composed of five subscales, as outlined in Section 4.8.2.4. Scores are calculated for each of these subscales separately, so, although the total MSBS score could only be calculated for

15 participants in Case 1, scores for each of the subscales could be calculated for between 17 and 19 participants in Case 1. The total number of participants who completed each subscale is indicated in Table 6.5.

6.3.1.3 *Motivation*

The VAS was completed in full by 90% of participants in Case 1 ($n = 18$) and by 88% of participants in Case 2 ($n = 14$). The two participants at Case 1 who did not complete the VAS were discharged prior to finishing the questionnaire and became lost to follow-up. The second missing VAS at Case 2 was not completed by the participant with language impairments who did not complete the DASS or MSBS (mentioned above).

6.3.2 ***Depression, anxiety, and stress questionnaire***

The DASS was used as a measure of depression, anxiety, and stress (see Section 4.8.2.4). Each scale within the DASS has recommended cut-off scores for conventional severity labels: normal, mild, moderate, severe, and extremely severe (Lovibond & Lovibond, 1995a). A larger percentage of participants at Case 2 reported severe or extremely severe levels of depression, anxiety, and stress compared to participants at Case 1 (see Table 6.4).

Table 6.4 Patient reported depression, anxiety, and stress

Depression, anxiety, stress categories	Case 1 (St George's) <i>n</i> = 20	Case 2 (Bendigo) <i>n</i> = 16 ¹
Depression scale, median (IQR) [<i>n</i>]	4 (0, 15) [20]	16 (10.5, 25.5) [14]
Normal (score 0-9), <i>n</i> (%)	14 (70)	3 (18.7)
Mild (score 10-13), <i>n</i> (%)	0 (0)	3 (18.7)
Moderate (score 14-20), <i>n</i> (%)	3 (15)	3 (18.7)
Severe (score 21-27), <i>n</i> (%)	1 (5)	2 (12.5)
Extremely severe (score 28+), <i>n</i> (%)	2 (10)	3 (18.7)
Anxiety scale, median (IQR) [<i>n</i>]	6 (1.5, 8) [20]	17 (3, 27.5) [14]
Normal (score 0-7), <i>n</i> (%)	14 (70)	5 (31.3)
Mild (score 8-9), <i>n</i> (%)	2 (10)	0 (0)
Moderate (score 10-14), <i>n</i> (%)	3 (15)	1 (6.3)
Severe (score 15-19), <i>n</i> (%)	0 (0)	3 (18.7)
Extremely severe (score 20+), <i>n</i> (%)	1 (5)	5 (31.3)
Stress scale, median (IQR) [<i>n</i>]	8 (1.5, 16) [20]	19 (8, 27.5) [14]
Normal (score 0-14), <i>n</i> (%)	14 (70)	5 (31.3)
Mild (score 15-18), <i>n</i> (%)	4 (20)	2 (12.5)
Moderate (score 19-25), <i>n</i> (%)	0 (0)	2 (12.5)
Severe (score 26-33), <i>n</i> (%)	1 (5)	3 (18.7)
Extremely severe (score 34+), <i>n</i> (%)	1 (5)	2 (12.5)

Acronyms: IQR = interquartile range

¹The Depression Anxiety Stress Scales were not completed by 2 participants at Case 2. Percentages show percent of all participants.

Figure 6.12 shows the reported depression, anxiety, and stress for participants with and without language and/or cognitive impairments at both cases. At both cases, participants with language and/or cognitive impairments appeared to have higher median levels of depression, anxiety, and stress than participants without these impairments. An exception was that participants with and without these impairments reported similar median anxiety levels at Case 1. In general, the participants at Case 1 without language or cognitive impairments had low levels of depression, anxiety, and stress; the IQRs of the scores reported by these participants fell within the ‘normal’

population range according to the cut-off scores included in Table 6.4 (median depression for participants without language or cognitive impairments at Case 1 = 2 [IQR 0, 5], median anxiety = 5 [IQR 1.5, 6], median stress = 2 [IQR 0, 13]). The IQRs for all other groups fell outside the ‘normal’ range (see Figure 6.12). To provide a more detailed exploration of mood and impairment at each case, the relationships between participants’ impairments (according to the NIHSS) and their self-reported depression, anxiety, and stress are explored in Appendix 19.

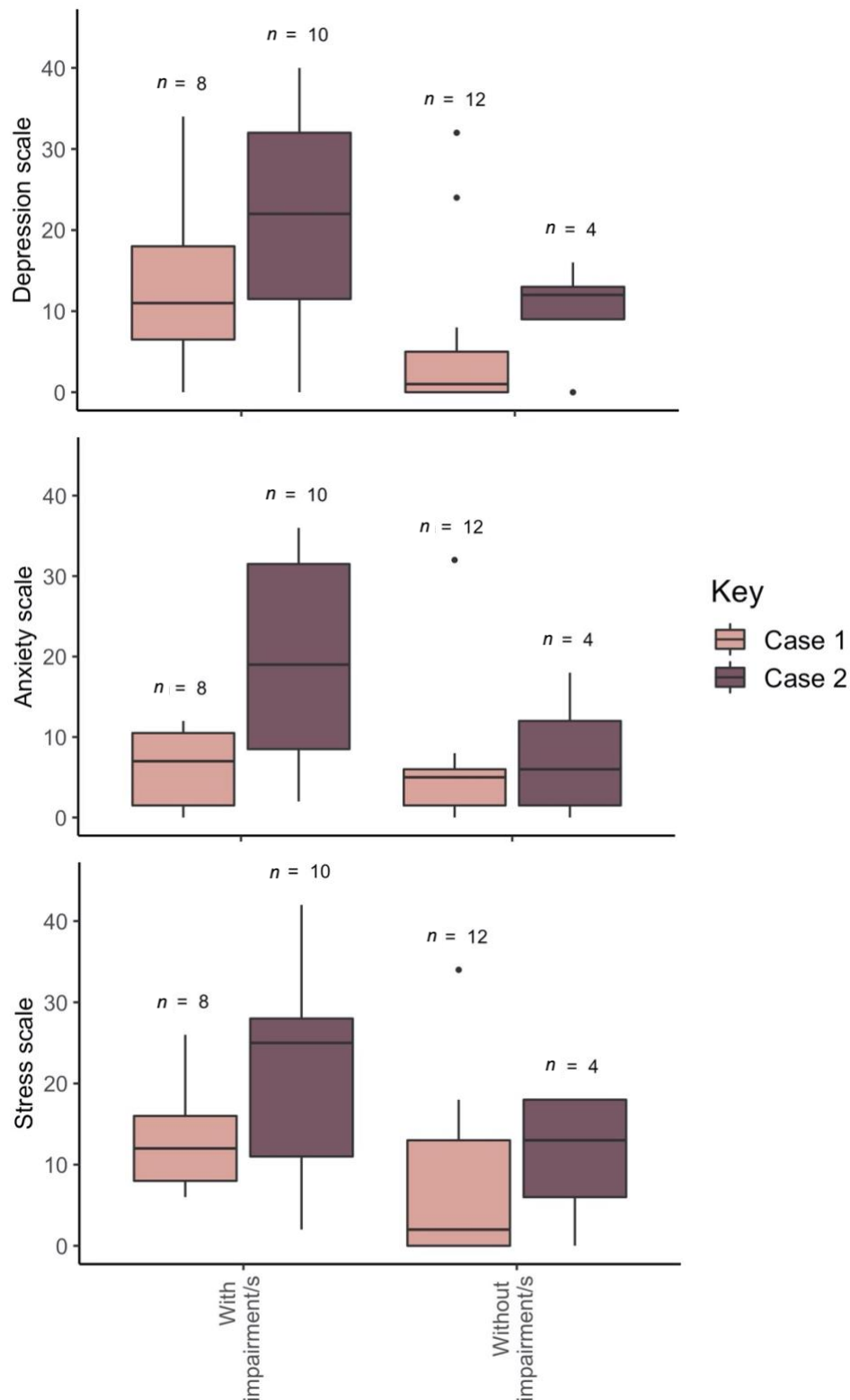


Figure 6.12 Median depression, anxiety, and stress reported by participants with and without language and/or cognitive impairments at each case

Higher scores on the Depression, Anxiety, Stress Scales (DASS) indicate higher levels of depression, anxiety, and stress. Boxes indicate median and interquartile range. Dots represent outliers. With impairments = participants with language and/or cognitive impairments. Without impairments = participants without language or cognitive impairments.

Figure 6.13 shows the median depression, anxiety, and stress scores for participants in single and shared bedrooms at each case. At Case 1, participants in single-bed rooms appeared to experience similar levels of depression, anxiety, and stress as participants in shared bedrooms. At Case 2, participants in single-bed rooms appeared to experience similar levels of anxiety as participants in shared bedrooms, but higher levels of depression and stress.

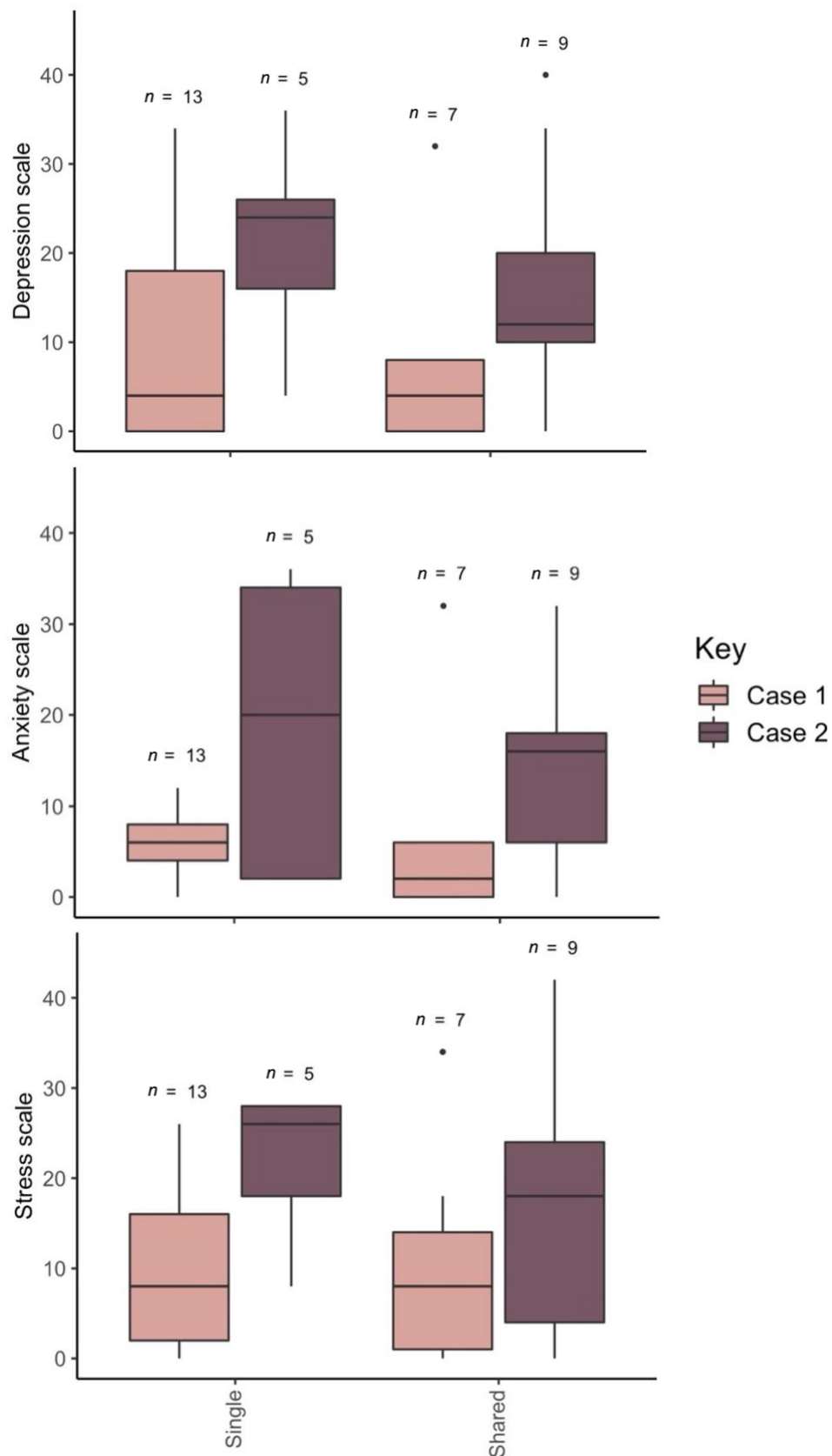


Figure 6.13 Median depression, anxiety, and stress reported by participants in single and shared bedrooms at each case

Higher scores on the Depression, Anxiety, Stress Scales (DASS) indicate higher levels of depression, anxiety, and stress. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

6.3.3 ***Boredom questionnaire***

The MSBS was used as a measure of boredom (see Section 4.8.2.4). Scores for participants at both cases are reported in Table 6.5, alongside the norms for a non-hospitalised population and associated z scores. The total score on the MSBS is calculated by summing all of the subscales that represent the five dimensions of boredom: disengagement, high arousal, inattention, low arousal, and time perception (see Section 4.8.2.4). Higher scores indicate more boredom. The minimum and maximum scores for the MSBS and for each subscale are listed under Table 6.5. At both cases, the mean boredom scores were within half a standard deviation of the population norms (i.e., z score ≤ 0.5), except for the scores on the time perception subscale, which appeared to be higher than the population norm.

Table 6.5 Patient reported boredom at each case and population norms

Boredom categories	Case 1 (St George's) <i>n</i> = 20	Case 2 (Bendigo) <i>n</i> = 16	Population norms ¹ <i>n</i> = 1,691 to 1,715
MSBS total,			
median (IQR) [<i>n</i>] ²	119 (67.5, 128) [15]	127 (95.8, 149) [14]	--
mean (SD)	97.4 (38.6)	117 (45.9)	97 (38.8)
z score	0.0	0.5	--
Disengagement	40 (29, 43) [17]	40 (27.5, 56.2) [14]	--
	35.9 (11.9)	40.2 (18)	35.7 (14.4)
	0.0	0.3	--
High Arousal	13 (8.5, 20.5) [19]	13 (8.3, 19.8) [14]	--
	14.5 (7.3)	15.4 (9.1)	16.4 (7.5)
	-0.3	-0.1	--
Inattention	15 (11.5, 19.8) [18]	16.5 (12.2, 22) [14]	--
	14.9 (6.1)	16.1 (7.1)	14.2 (6)
	0.1	0.3	--
Low Arousal	18 (6.5, 20.5) [19]	21 (16.2, 25.5) [14]	--
	15.3 (8.3)	20.6 (9.5)	16.6 (8.2)
	-0.2	0.5	--
Time Perception	18.5 (13, 23) [18]	26.5 (18, 32.8) [14]	--
	18.7 (7.8)	25.1 (8.6)	14.1 (7.1)
	0.7	1.6	--

Acronyms: MSBS = Multidimensional State Boredom Scale, IQR = interquartile range.

MSBS Total minimum score = 29, maximum score = 203. Disengagement subscale minimum score = 10, maximum score = 70. High Arousal subscale minimum score = 5, maximum score = 35. Inattention subscale minimum score = 4, maximum score = 28. Low Arousal subscale minimum score = 5, maximum score = 35. Time Perception subscale minimum score = 5, maximum score = 35.

¹Australian population norms (non-hospitalised sample) are published by Oxtoby et al. (2016). Medians and IQRs of the population norms are not provided in this publication. The exact *n* for each subscale is not specified in the publication, but it is stated that the *n* for each subscale varied between 1,691 and 1,715.

²Subscales were completed by a different number of participants at each case.

At both cases, participants with language and/or cognitive impairments appeared to report slightly higher levels of boredom than participants without language or cognitive impairments (see Figure 6.14). The means, standard deviations, and *z* scores for participants with and without language and cognitive impairments at both cases are reported in Appendix 19. At Case 1, participants with these impairments appeared to report a mean score slightly above the population mean, while participants without these impairments appeared to report a mean score slightly below the population mean. At Case 2, participants with and without these impairments both appeared to report a mean score above the population mean. For participants with and without these impairments at both cases, the time perception subscale had a higher *z* score than the other MSBS subscales (see Appendix 19).

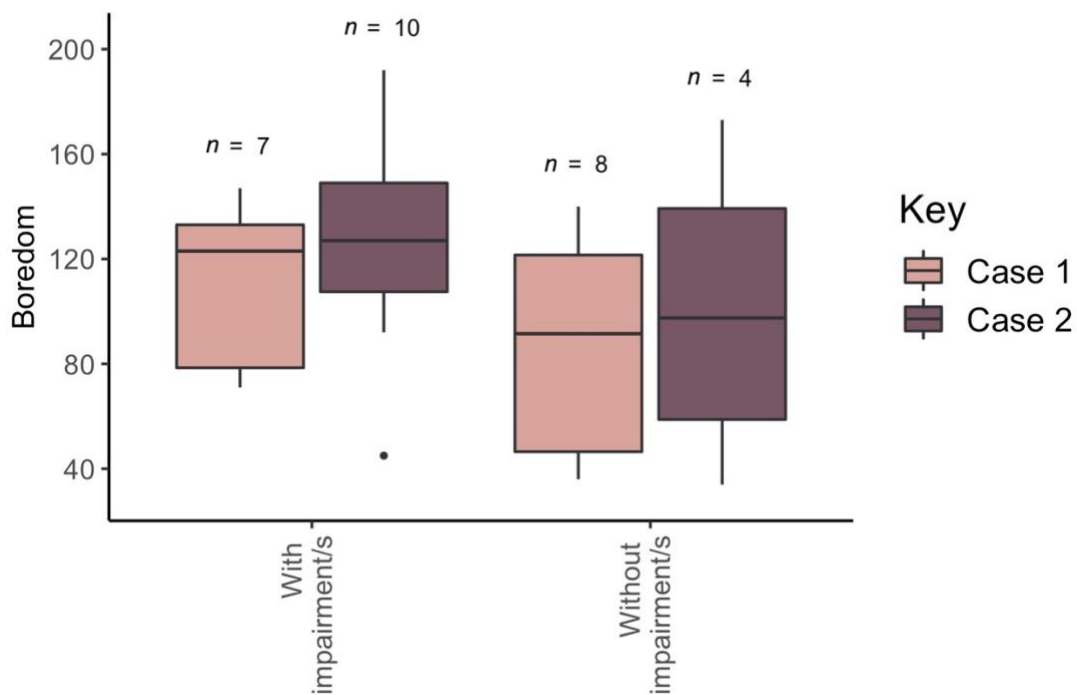


Figure 6.14 Median boredom reported by participants with and without language and/or cognitive impairments at each case

Higher scores on the Multidimensional State Boredom Scale (MSBS) indicate higher levels of boredom. Boxes indicate median and interquartile range. Dots represent outliers. MSBS Total minimum score = 29, maximum score = 203. With impairments = participants with language and/or cognitive impairments. Without impairments = participants without language or cognitive impairments.

Figure 6.15 shows the median boredom scores for participants in single and shared bedrooms at each case. At both cases, participants in single-bed rooms appeared to experience more boredom than participants in shared bedrooms. At Case 2, the mean MSBS score was higher than the population mean for participants in single-bed room but within half a standard deviation of the population mean for participants in a shared bedroom (single-bed room: mean = 139, $SD = 25.2$, z score = 1.1; shared bedroom: mean = 105, $SD = 51.5$, z score = 0.2); while at Case 1, the mean score for participants in a single-bed room was similar to the population mean

and the score for participants in a shared bedroom was lower than the population mean (single-bed room: mean = 109, $SD = 34$, z score = 0.3; shared bedroom: mean = 74.6, $SD = 40.5$, z score = -0.6).

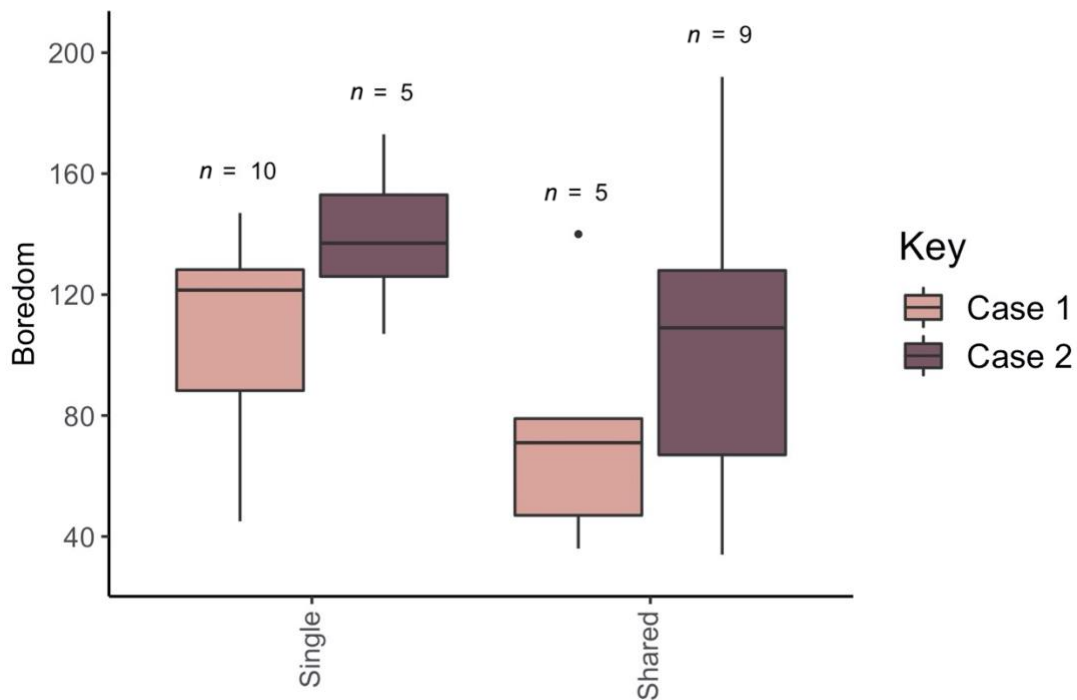


Figure 6.15 Median boredom reported by participants in single and shared bedrooms at each case

Higher scores on the Multidimensional State Boredom Scale (MSBS) indicate higher levels of boredom. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

6.3.4 **Motivation questionnaire**

The VAS was used as measure of how much participants thought the physical environment helped them to feel motivated to participate in rehabilitation practice and activity. A score of zero on the VAS indicated that the participant found the environment strongly demotivating, while a score of 100 indicated that they found it strongly motivating. The median score for participants in Case 1 was 63 (IQR 45.5,

73.5, range = 0-94), which appeared to be higher than for participants in Case 2 (median = 40, IQR 7, 84, range = 0-100). At both cases, participants with language and/or cognitive impairments indicated similar median levels of motivation from the environment as participants without these impairments (see Figure 6.16).

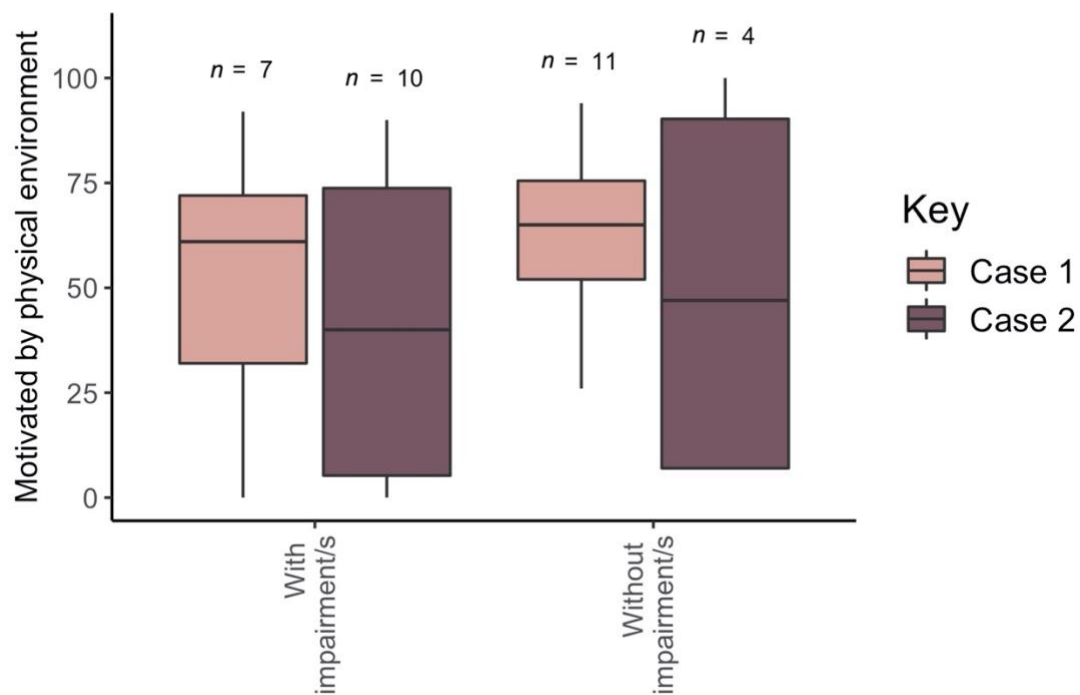


Figure 6.16 Median extent to which participants with and without language and/or cognitive impairments at each case found the physical environment to be motivating for rehabilitation.

The extent to which the physical environment was motivating was measured using a Visual Analogue Scale where a score of 100 indicated that the physical environment was strongly motivating and a score of 0 indicated that it was strongly demotivating. Boxes indicate median and interquartile range. Dots represent outliers. With impairments = participants with language and/or cognitive impairments. Without impairments = participants without language or cognitive impairments.

Figure 6.17 shows the VAS scores for participants in single and shared bedrooms at both cases.

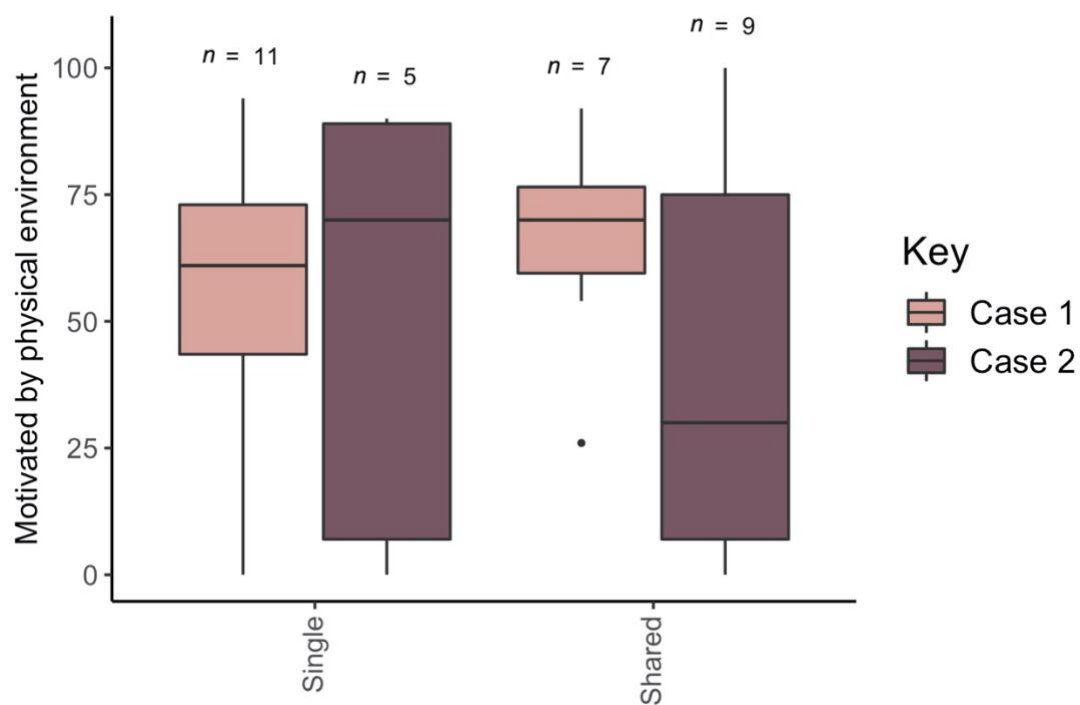


Figure 6.17 The median extent to which participants in single and shared bedrooms at each case found the physical environment to be motivating for rehabilitation.

The extent to which the physical environment was motivating was measured using a Visual Analogue Scale where a score of 100 indicated that the physical environment was strongly motivating and a score of 0 indicated that it was strongly demotivating. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

6.3.5 Cross-case comparison

6.3.5.1 Low levels of depression, anxiety, and stress at Case 1

The majority of participants at Case 1 (SG) were within the ‘normal’ range for depression, anxiety, and stress, while the majority of participants at Case 2 (BH) were not (see Table 6.4). The higher rates of depression, anxiety, and stress at Case 2 (BH) could be explained by the demographic and clinical differences between the cases

(see Table 5.4, page 130, and Table 5.5, page 132). For example, participants at Case 2 (BH) were younger and suffered more severe impairments than at Case 1 (SG) (see Section 5.3), and both these characteristics are predictors of post-stroke depression (Carota et al., 2005). In addition, some mental health issues are known to increase with rurality (Australian Institute of Health and Welfare, 2019), so it is possible that the participants at the regionally located Case 2 (BH) may have already had lower mood prior to their stroke, although this was not measured. Ultimately, there are many internal (demographic or clinical) patient competencies which may explain the lower mood at Case 2 (BH).

An alternative explanation is that the environment at Case 1 (SG) may have been somehow protective of patients' moods, just as it may have been somehow encouraging of activity compared to other hospital environments (see Section 6.2.4.2). Depression and anxiety are common post-stroke (see Section 1.2.3), and the levels of depression, anxiety, and stress at Case 2 (BH) appeared to be comparable to the moderate to severe levels reported in previous studies of hospitalised stroke patients (Khan et al., 2016). The mood results at Case 2 (BH) are therefore perhaps less surprising than the comparatively low levels of depression, anxiety, and stress at Case 1 (SG). The majority of participants at Case 1 (SG), and almost all of the participants without language or cognitive impairments at this case, reported 'normal' levels of depression, anxiety, and stress (see Table 6.4 and Figure 6.12). Participants at Case 1 (SG) also found the environment more motivating than participants at Case 2 (BH) (see Section 6.3.4). This motivation may be part of the reason that participants at Case 1 (SG) appeared to do more physical and cognitive activity and spend slightly less time in their bedrooms compared to participants at Case 2 (see Section 6.2). Unfortunately, no conclusions can be drawn regarding what aspects of the physical

environment at Case 1 (SG) may have played a supportive role in the mood and motivation of participants at this case.

Regardless, the patterns in Figure 6.12 indicate that depression, anxiety, and stress varied depending on both impairment type (lower for participants without language or cognitive impairments) and case (lower for participants at Case 1). It therefore appears that participants' emotional well-being may have been influenced by both internal factors (patient competencies) and external factors (some aspect/s of the social and/or physical environment of the cases).

6.3.5.2 Boredom and time perception in the rehabilitation environment

The mean scores for each subscale of the MSBS appeared to be slightly higher at Case 2 (BH) compared to Case 1 (SG) (see Table 6.5), however, the *z* scores for both cases were similar for most of the subscales (with the exception of the time perception subscale, discussed below) which indicates that it is unlikely that the differences in scores between the cases reflected meaningful differences in boredom.

Considering the differences in participant profile and environment at the two cases, it is perhaps surprising that the boredom scores were so similar. There may have been something common to the experience of the participants at both cases that was responsible for the similarity in boredom scores. The time perception subscale was the only subscale that appeared both different from the population norms and different between the cases (see Table 6.5). Participants at both cases, and especially at Case 2 (BH), appeared to report more changes in their perception of time on the MSBS compared to the population norm. According to Oxtoby et al. (2016), the time perception subscale is the least intercorrelated subscale of the MSBS, that is, while all the MSBS subscales have some overlap in the constructs that they measure, the time perception subscale addresses a more unique concept compared to the other subscales.

Participants at both cases spoke in interviews about the experience of feeling trapped in time as well as space (see Section 5.4, Theme 1 ‘Entrapment and escape’). Indeed, another qualitative study with stroke rehabilitation patients similarly reported that patients felt trapped in time (Turner, 2012). These findings suggest that the aspect of boredom that is measured by the time perception subscale – feeling trapped in time and that time is passing slowly – may be what sets the in-hospital stroke rehabilitation experience apart from the boredom experienced by the general population.

There were some features in the bedrooms at Case 2 (BH) which may have impacted patients’ time perception and could therefore explain the apparently higher score on this subscale at Case 2 (BH) compared to Case 1 (SG). For example, there were no clocks on the walls in the bedrooms at Case 2 (BH), whereas all of the bedrooms at Case 1 (SG) had clocks (most of which were set at the correct time), and the window blinds at Case 2 (BH) were much better at blocking out light, making it harder to follow the passing of time if they were closed during the day.

6.3.5.3 Environments for people with language and/or cognitive impairment

At both cases, participants with language and/or cognitive impairments appeared to experience more depression, anxiety, stress, and boredom than participants without these impairments, with the exception that participants with and without these impairments reported similar median anxiety levels at Case 1 (SG) (see Figure 6.12, Figure 6.14, and Appendix 19). In particular, the participants with language and/or cognitive impairments at Case 2 (BH) appeared to have more depression, anxiety, stress, and boredom than all other participants at both cases (see Figure 6.12, Figure 6.14, and Appendix 19). This group of participants were also the least active (see Section 6.2.2.3). There did not appear to be a striking difference in the median amount that participants with and without these impairments found their

environment motivating (see Figure 6.16). These findings suggest that the environment disproportionately negatively impacts the mood and boredom of patients with language and/or cognitive impairments, but not their motivation. As mentioned in Section 6.2.4.9, there may have been differences in the nature of the language and/or cognitive impairments between the cases which may have led to differences in emotional well-being and behaviour.

6.3.5.4 *Emotional well-being in single and shared bedrooms*

Participants in both single and shared bedrooms at Case 2 (BH) appeared to experience more severe levels of depression, anxiety, and stress compared to participants in either room type at Case 1 (SG), that is, depression, anxiety, and stress appeared to vary more by case than by number of beds in the room (see Figure 6.13). This suggests that other factors besides the number of beds in the room played a more important role in participants' mood. These other factors may have been internal participant competencies (such as the demographic and clinical characteristics which differed between cases) and/or external factors in the social and physical environment such as those suggested in Section 6.2.4.5 (e.g., roommates' impairments, type of barriers/curtains between beds, position of bedroom relative to communal hubs, etc.).

Participants did, however, appear to experience more boredom in single-bed rooms compared to shared bedrooms at both cases (see Figure 6.15). Participants were more alone in single-bed rooms at both cases (see Section 6.2.4.6 and Figure 6.6), which may have contributed to their boredom. It is difficult to compare these findings to past research as a recent systematic literature review found no studies that investigated the impact of single versus shared bedrooms on emotional well-being in stroke patients, nor in people with neurological impairments more broadly (Shannon et al., 2018).

Participants in single-bed rooms at Case 2 (BH) appeared to find the environment more motivating than participants in shared bedrooms at this case, but participants in single and shared bedrooms at both cases varied widely in how motivating they found the environment (see medians and IQRs in Figure 6.17). This wide spread of responses suggests that motivation, like mood, may have been driven more by other factors than by the number of beds in the room.

6.3.5.5 *Emotional well-being and sleep*

One participant without language or cognitive impairments was an outlier for depression, anxiety, and stress at Case 1 (SG) (Figure 6.12). This participant was independently mobile and was in a shared bedroom. He commented in his interview that poor sleep was his biggest concern, indeed, his score on the PSQI was the highest at Case 1 (score of 15), suggesting that his sleep quality was particularly poor compared to the other participants at this case. This is consistent with known associations between poor sleep quality and increased depression and anxiety post-stroke (Glozier et al., 2017).

6.3.5.6 *Heterogeneity of emotional well-being and of opinions about environment*

Participants with language and/or cognitive impairments at Case 2 (BH) were more heterogeneous in their reported depression, anxiety, and stress than the other participant groups at both cases (see IQRs in Figure 6.12). Participants in Case 2 (BH) were similarly heterogeneous in their opinion of whether the environment helped them to feel motivated for rehabilitation (see IQRs in Section 6.3.4). The environment at Case 2 (BH) was less heterogeneous than at Case 1 (SG) (see Section 5.2), so while the behavioural mapping results suggest that heterogeneous behaviour might emerge

from a heterogeneous environment (see Section 6.2.4.10), this does not appear to be the case for mood or motivation. While the environment at Case 2 (BH) was quite uniform, participants' responses to this environment were not; some of the participants at Case 2 (BH) found the modern clinical environment comforting, while others found it institutional and dull (see Section 5.4.3.2). The heterogeneity in emotional well-being at Case 2 (BH) may therefore be associated with variations in opinion about the physical environment, rather than variations in the physical environment per se. This will be explored further when the qualitative and quantitative results are merged in Chapter 7.

6.4 Patient safety: Falls audit

This section contains the results of the falls audit that was used to address research question 2c and describe stroke patients' safety in inpatient rehabilitation (see Figure 6.1 above, methods are outlined in Section 4.8.2.5). The audit was conducted using retrospective records of reported patient falls. These retrospective records were obtained for the 12-month period that preceded the start of data collection at each case: between October 2017 and September 2018 at Case 1 (SG) and between November 2017 and October 2018 at Case 2 (BH). Only the falls experienced by stroke patients on the rehabilitation ward were included in the audit. The results of the audits for both cases are reported first (Section 6.4.1) followed a cross-case comparison (Section 6.4.2).

6.4.1 *Retrospective records of reported stroke patient falls*

The records indicated that 25% of stroke patients experienced a fall at Case 1 and 21% experienced a fall at Case 2 during the 12-month period (see Table 6.6). At

both cases, the average length of stay of the patients who fell was longer than the average length of stay of all stroke patients during that period (32.9 days longer at Case 1 and 21.1 days longer at Case 2). At Case 1, 30.8% ($n = 4$) of the stroke patients who fell experienced more than one fall (mean number of falls per multiple faller = 3.3, range = 2 to 4), bringing the total number of reported falls involving a stroke patient to 22. At Case 2, 50% ($n = 8$) of the stroke patients who fell experienced more than one fall (mean number of falls per multiple faller = 5, range = 2 to 21). One patient at Case 2 fell a total of 21 times, bringing the total number of reported falls to 48. The length of stay of this patient was 174 days. If this extreme outlier is excluded from Case 2, the total number of falls per stroke patient at this case drops to 0.4, which is equivalent to Case 1 (see Table 6.6), and the mean number of falls per multiple faller drops to 2.7 (range = 2 to 5), which is less than at Case 1.

Table 6.6 Stroke patients and reported falls over a 12-month period

Stroke patients and falls	Case 1 (St George's)	Case 2 (Bendigo)
Stroke patients admitted to ward, n	52	75
Length of stay, days, mean (SD)	34.1 (40.4)	32.7 (30.7)
Stroke patients who fell, ¹ n	13	16
Length of stay, days, mean (SD)	67 (68.4)	53.8 (44.1)
Falls involving stroke patients, n	22	48
Falls per stroke patient, n	0.4	0.6

¹Five stroke patients at Case 1 fell more than once. Eight stroke patients at Case 2 fell more than once.

In both cases, all of the reported falls occurred on the ward. Table 6.7 details where the falls occurred, why they occurred, whether staff were present, and whether an injury was reported. Three of the reported falls in Case 1 resulted in minor injury (13.7%) including a grazed knee, hip pain, and a skin tear on the patient's arm (not requiring stitches). All of the falls that resulted in injury at Case 1 occurred in the

bedroom. Two were a result of the patient falling from bed (one because he was trying to reach his glasses) and one occurred because the patient tripped over an object while reaching for his mobile phone. Seven of the falls in Case 2 (BH) resulted in injury (14.6%), but the nature of the injury was only reported for two of these seven falls (skin tear and hit head). Two of the seven falls occurred in the bedroom (both were a fall from bed), four in the bathroom (one fall from a chair, one fall while standing/walking, and two reason unrecorded), and the location of one fall was not recorded.

Table 6.7 Location, context, and outcome of reported falls for stroke patients

Location, context, and outcome of falls	Case 1 (St George's) <i>n</i> = 22	Case 2 (Bendigo) <i>n</i> = 48
Location, <i>n</i> (%)		
Bedroom	19 (86.4)	20 (41.7)
Bathroom	3 (13.6)	18 (37.5)
Not reported	0 (0)	10 (20.8)
Staff present, <i>n</i> (%)		
Yes	9 (40.9)	4 (8.3)
No	13 (59.1)	34 (70.8)
Not reported	0 (0)	10 (20.8)
Reason for fall ¹ , <i>n</i> (%)		
Fall from bed	9 (40.9)	16 (33.3)
Transfer (assisted)	4 (18.2)	4 (8.3)
Reaching for object	3 (13.6)	None reported
Trip over obstacle	3 (13.6)	None reported
Transfer (unassisted)	2 (9.1)	1 (2.1)
Fall from chair	2 (9.1)	9 (18.8)
Fall while standing or walking	2 (9.1)	8 (16.7)
Unknown or not reported	1 (4.6)	10 (20.8)
Injury reported, <i>n</i> (%)		
No	19 (86.4)	41 (85.4)
Yes	3 (13.7)	7 (14.6)

¹At Case 1, one fall occurred because of a combination between reaching for an object, standing, and tripping over an obstacle, and two falls occurred because of a combination of reaching for an object and falling from bed, so the total of 'Reasons for fall' = 26 at Case 1.

In general, the records obtained from Case 1 (SG) were more comprehensive than those from Case 2 (BH) (see the 'not reported' variables in Table 6.7). As such, some additional details could be garnered from the Case 1 records in addition to those included in Table 6.7. For example, at Case 1, the majority of the patients who fell from bed specified that they had been trying to get to the bathroom (86%, *n* = 6). Also, of the 22 falls at Case 1, four (18%) were brought to the attention of staff by a

proximate alarm that was in place prior to the fall. These alarms successfully alerted staff to the patients' movement, but the patients had already fallen by the time staff could arrive. A further two patients in Case 1 had been assigned a proximate alarm prior to their fall, but this had not alerted staff: one alarm had failed to go off and the other couldn't be located after the fall occurred. In other words, one third of the assigned proximate alarms in Case 1 did not fulfil their intended function, and the remainder alerted staff to the fall only after it had occurred. A sensor mat which had failed to alarm was mentioned in relation to one of the falls in Case 2, but no other sensors were mentioned in the reports from this case.

6.4.2 Cross-case comparison

6.4.2.1 Incidence of falls and injury similar between cases

In previous studies, the percentage of stroke patients who fell while in hospital has ranged between 16% and 47% (Czernuszenko & Czlonkowska, 2009; Eikenberry, Ganley, Zhang, & Kinney, 2019; Suzuki et al., 2005; Teasell, McRae, Foley, & Bhardwaj, 2002; Wong, Brooks, & Mansfield, 2016). Given this wide range, it is notable that there was only a 4% difference in the percentage of stroke patients who experienced a fall at cases 1 and 2 (see Table 6.6). The incidence of injury has also ranged widely in previous reports of stroke patient falls, from 8.4% to 33% (Czernuszenko & Czlonkowska, 2009; Suzuki et al., 2005; Teasell et al., 2002; Wong et al., 2016). The incidence of injuries in this study was low compared to previous reports, and hardly varied between the cases (less than 1% difference between cases, see Table 6.7). This suggests that there may be something common to both cases that plays a role in whether patients fall and whether they get injured.

6.4.2.2 *More repeat falls at Case 2*

There appeared to be a higher proportion of patients at Case 2 (BH) who experienced multiple falls compared to Case 1 (SG). This indicates that patients who fell at Case 2 (BH) were more likely to have repeat falls than those who fell at Case 1 (SG). The total number of falls in a given period does not reflect how many patients experienced a fall. It is possible that the patients who fell at Case 2 (BH) may have been more unwell and therefore more likely to fall multiple times than the patients at Case 1 (SG), but this cannot be determined because information regarding functional status and stroke severity was not included in the falls records.

An alternative explanation is that the procedural response to falls was somehow more effective at Case 1 (SG) than at Case 2 (BH), thereby preventing repeat falls. Unfortunately, the falls records do not provide enough detail to determine how staff responded to each fall. Occasionally, information was provided in the Case 1 (SG) records to indicate that staff did make changes to the physical environment in response to a fall (e.g., adjusting the angle of a chair, lowering the height of a bed, or putting a proximate sensor in place). Such detail is not provided in the Case 2 (BH) records, but this may reflect a difference in record-keeping rather than a difference in procedural response to falls. The implications of the apparent differences in record-keeping between the two cases will be discussed further in Section 6.5. Whatever the reason for multiple falls, certain adjustments may need to be made in the physical environment for patients who repeatedly fall, but these adjustments may not be necessary or appropriate for all patients.

6.4.2.3 *Inconvenience, isolation, and surveillance in the bedroom*

At both cases, the majority of reported falls occurred in the patient's bedroom (see Table 6.7), which is consistent with previous research (Czernuszenko &

Czlonkowska, 2009; Suzuki et al., 2005). If these patients spent as much time in their bedroom as the patients who participated in the behavioural mapping (see Section 6.2.2.1), then it is perhaps unsurprising that the majority of falls occurred in this location. Falls from bed were the most common reason for a fall; patients sometimes fell from bed because they needed to use the bathroom and sometimes because they were trying to reach an object (see Table 6.7).

In interviews, participants at both cases described the nurse call-bell as unreliable and said that the environment felt inconvenient with objects often being out of their reach (see Section 5.4). It is therefore understandable that patients might attempt to get to the bathroom or reach an object unassisted. In addition, there were other aspects of the physical environment that were common to both cases which could have contributed to the falls from bed. At both cases, there were limited surfaces in the bedroom for patients to put their belongings (so objects may have been more likely to be placed out of reach), most ensuite bathrooms were positioned within line of sight of the bed, and there were no handrails along the wall between the bed and the bathroom. Previous research has found that carefully placed handrails in the bed and bathroom, and a clear, uncluttered passage to the bathroom can reduce patient falls (Pati et al., 2017).

At both cases, the majority of the reported falls occurred when a staff member was not present (see Table 6.7). Indeed, the actual proportion of unwitnessed falls may have been even greater than what is indicated in the records as it is conceivable some may not have been reported. At both cases, the patients in the behavioural mapping cohort were often alone, especially in the bedroom (see Section 6.2.2.2), and participants reported experiencing isolation in their bedrooms (see Section 5.4).

6.4.2.4 *Falls and the dimensions of the bathroom*

There appeared to be a greater proportion of falls that occurred in the bathrooms at Case 2 (BH) compared to Case 1 (SG) (Table 6.7). It is possible that patients at Case 2 (BH) may have spent more time in the bathrooms compared to patients at Case 1 (SG), however, this is not supported by the behavioural mapping results (see Section 6.2.2.1). Indeed, according to the behavioural mapping, participants at Case 2 (BH) were less likely to have been alone in the bathroom than participants at Case 1 (SG) (see Section 6.2.2.2), which presumably should have resulted in fewer falls in this location rather than more. Having said this, there are limitations to using the behavioural mapping results to infer the behaviour of the patients in the falls records; these are two different patient samples, and the behavioural mapping results may not reflect the behaviour of all patients at that case. The greater proportion of falls in the bathroom at Case 2 (BH) could therefore very well have been a result of differences in clinical profile or behaviour between the cases.

There was, however, one notable difference in the physical environment of the bathrooms between the two cases which could have played a role in the rate of bathroom falls. The bathrooms at Case 2 (BH) were noticeably larger than those at Case 1 (SG) (see floor plans in Appendix 13), and while this was mentioned as a positive thing in interviews (see Section 5.4.3.2), it is possible that the greater distances between amenities, walls, and surfaces could have resulted in fewer adjacent hand-holds and so more falls in the bathrooms at this case.

6.5 Discussion

This chapter presented the exploratory results of quantitative measures of stroke patient behaviour, emotional well-being, and safety in two inpatient rehabilitation facilities in Victoria, Australia. Cross-case comparison was used to interpret these results, hypothesise about how the physical environment may have contributed to the findings, and compare the results to past research (see Sections 6.2.4, 6.3.5, and 6.4.2 above). These cross-case comparisons will be integrated in the convergent mixed methods analysis in Chapter 7. To avoid repetition, the content of the cross-case comparisons will not be revisited in this present discussion section, instead, this section will reflect on the strengths and limitations of the methods and measures reported in this chapter.

6.5.1 *The strengths and limitations of a diverse sample*

Efforts were made to include a diverse sample of participants in this study (see Section 4.6.1). The efforts were largely successful, but also presented limitations and challenges.

6.5.1.1 *Representative research*

The results in this chapter illustrate some of the benefits of including a diverse sample of participants. For example, if participants with language and/or cognitive impairments had been excluded, or had not been enabled and encouraged to participate, then the behavioural mapping results would have suggested that patients were less active at Case 1 (SG) than at Case 2 (BH) (see the results for participants without these impairments in Table 6.2), which is the opposite of what was indicated by the results of the full sample of participants (see Figure 6.9). Forethought, planning, and additional resources were required to facilitate the inclusion of

participants with language and/or cognitive impairments (see Section 4.6.1), but these efforts were undoubtedly worthwhile for both the qualitative and quantitative components of this study (see Section 5.5.4) and should be considered for all stroke research. This was a particular strength of the methodology for Study 3, and will be discussed further in Chapters 7 and 8.

6.5.1.2 *Data completeness*

While these efforts did help patients to participate, the extent of the missing questionnaire data in this study highlight the challenges of data completeness in this population (Walker et al., 2017). The majority of the data that were missing from the PSQI, DASS, MSBS, and VAS were due to participants with language impairments not feeling confident to complete the questionnaires, even with support (see Sections 6.2.1.2 and 6.3.1). The adapted Questionnaire Booklet (with larger font and pictures, see Section 4.6.1) was useful (indeed, even participants without language or cognitive impairments chose to use these adapted materials, see Section 5.5.4.2), but the adapted materials were evidentially not sufficient for some participants, particularly those who did not understand the wording of the questions, were confused by the response scale, or were overwhelmed by the number of questions. There is a limit to how much a questionnaire can be adapted without jeopardising the validity of the measure – the response scale and the number and wording of the questions cannot be changed. There is a need for validated, aphasia-friendly versions of standard questionnaires. In the absence of these, future research could utilise proxy measures of emotional well-being such as carer testimony or physiological measures (which will be discussed further in Section 7.4.2.2). Having said this, many people with language and cognitive disorders can communicate if given the right support (as discussed in Section 5.5.4.3), so measures that rely on patient report should not be

entirely discounted in this population. Other alternatives to measuring emotional well-being will be explored in the discussion section of Chapter 7.

6.5.1.3 *Describing patient competencies*

In this chapter, participants with language and/or cognitive impairments were compared to participants without these impairments to explore how behaviour and emotional well-being in the physical environment varies depending on patient competencies, which is a main tenet of Person-Environment Fit theory (see Sections 1.3.2 and 4.2). The MoCA and the NIHSS were used to identify language and cognitive impairment (see Section 5.3.3). These tools have good sensitivity and specificity compared to gold-standard neuropsychological batteries and are recommended for use in stroke research (Kwakkel et al., 2017; Pendlebury, Mariz, Bull, Mehta, & Rothwell, 2012), but they do not provide detailed information about the nature of the impairment. Every stroke patient is different (see Section 1.2), and the type and extent of language or cognitive impairment may be very different from one stroke patient to the next, leading to very different behaviours (Cumming et al., 2013). If more detailed assessment of impairment had been completed, a much larger sample size would have been required to explore differences in behaviour and emotional well-being between patients with different types of language and cognitive impairment. So, while a binary grouping (i.e., those with and without language and/or cognitive impairment) greatly oversimplifies the nature of post-stroke impairment, it was useful in the context of this exploratory study, especially given the small sample size.

6.5.1.4 *Sampling approach*

There were more participants with language and/or cognitive impairment at Case 2 (BH) compared to Case 1 (SG), and there were a number of other demographic and clinical differences between the cases (see Section 5.3), all of which needed to be taken into account in the interpretation of results and cross-case comparisons. These demographic and clinical differences between the cases were likely a result of the convenience sampling method that was used in this study (see Section 4.7). Alternative sampling methods, such as purposive sampling, would have provided an avenue for matching the participants at the two cases on certain variables such as age, stroke severity, type of impairment, etc. Convenience sampling, however, is more likely to produce a sample that is representative of the population at that case, which is recommended for case study research (Yin, 2017). What is more, purposive sampling would have involved waiting for matched patients to be admitted to each case and so would have required a much longer data collection period, which would not have been feasible for this study.

6.5.2 *Alternatives to behaviour observation*

Behavioural mapping provided detailed data about each participant's location and behaviour throughout the day, and good data completeness was achieved (see Section 6.2.1.1). While effective, this method of data collection has some limitations and requires significant time investment from the researcher. It is worth considering whether alternative methods could have been used.

6.5.2.1 *Is an epoch representative of behaviour?*

In this study, behavioural mapping was conducted for between one and four participants concurrently, depending on the number of patients participating in the

study at any given time, so it took 17 nine-hour observation days (153 hours in total) to collect the behavioural mapping data for all the participants. Because of the time investment required, each participant's behaviour was observed on one day only. This limits the extent to which a participant's results can be generalised as it does not account for how behaviour may vary from one day to the next, on weekends compared to weekdays (Fini, Burge, Bernhardt, & Holland, 2019; McRae et al., 2020), and over the course of rehabilitation (Fini, Holland, Keating, Simek, & Bernhardt, 2017). In addition, at each epoch, the participant was presumed to have participated in that activity for the preceding ten minutes, and so the combined epochs may not be a complete representation of their activity through the day.

6.5.2.2 *Technological alternatives*

Given the time investment required to collect the behavioural mapping data – and the limitations to generalising this data over an epoch, day, week, and inpatient stay, it is worth considering how more complete information could be obtained via less demanding means. Pedometers or accelerometers can be used to estimate stroke patients' physical activity (Kramer, Cumming, Churilov, & Bernhardt, 2013), but, to be useful in People-Environment research, such devices would need to be paired with additional technology to provide contextual information about the person's location. Real Time Locating Systems (RTLS) are included in some new hospital buildings to track the whereabouts of tagged medical equipment (examples of such technology currently in use in hospitals in Australia include [AeroScout](#) and [AiRISTA](#)). During the study design phase of this multiple-case study, I met with an engineer (David Collins, Arup) who has experience using RTLS in hospitals. The purpose of this meeting was to determine the feasibility of adapting such systems to track patients instead of equipment. This approach has been trialled in other healthcare settings

besides stroke (Castner & Suffoletto, 2018; Dorrell, Vermillion, & Clark, 2017), but the ethical and technological challenges of such an approach were deemed too high-risk and costly for a resource-limited PhD study.

6.5.2.3 *Experience sampling methods*

What is more, such tracking systems would not have been ideal for the present study as they do not provide information about patients' cognitive or social activity. An alternative approach could have been to use an experience sampling method whereby the participant is prompted at set times throughout the day to answer specific questions about what they are doing, where they are, and how they feel at that particular time (Hektner & Csikszentmihalyi, 2003). The experience sampling methodology influenced the development of smartphone apps, such as [unforgettable.me](#), designed to facilitate continuous, real-time collection of human experience, including location and behaviour (Dennis, Yim, Garrett, Sreekumar, & Stone, 2019). These methods have the benefit of also being a means to collect information regarding emotional well-being. However, since these methods rely partly on self-report, they likely present similar problems as questionnaires when they are used in populations with language and cognitive impairments. This will be discussed further when alternatives to measuring emotional well-being are explored in Chapter 7.

Although time-intensive, behavioural observation was the appropriate method in the context of this research. Having said this, behaviour sampling and tracking technology is improving rapidly and there are likely to soon be viable alternatives to use in order to study behaviour in context, even in complex populations where cognitive and language skills vary.

6.5.3 ***Retrospective falls audits as an indication of safety***

The retrospective records of patient falls and injuries produced some useful data about the location and reason for falls, however, the records that were used were collected for internal quality and safety purposes, and not for the purposes of research about the role of the environment in patient safety, which led to some limitations with the dataset.

6.5.3.1 ***Differences in record-keeping***

The information included in the records varied between the two cases, with the records at Case 1 (SG) providing more detail than the records at Case 2 (BH). For example, when describing the reason for the fall, the records from Case 2 (BH) provided limited information (e.g., “fall from chair”), whereas the records at Case 1 (SG) provided more context (e.g., “fall from chair while reaching for magazine”) which helped me to better understand the role of the physical environment. These differences in record-keeping led to missing data in the falls audit (see Table 6.7, page 246), and some of the apparent differences between the cases may have been due to differences in record-keeping rather than differences in patient falls.

Differences in record-keeping between hospitals are not unexpected. Reporting protocols vary between hospitals, and there is no internationally recognised reporting standard for falls (Hill et al., 2010). While retrospective audits have the benefit of utilising pre-existing data, studies with more extensive resources could benefit from conducting a prospective audit of falls instead, and thereby ensuring that identical reporting protocols are in place at each site before data collection commences.

A prospective audit would also allow the researcher to ensure that all relevant variables were defined and collected, such as additional patient and environmental

characteristics. People with communication impairments are particularly at risk of falls (Hemsley et al., 2019), but the falls records used in this study did not provide many clinical details about the patients, which made it impossible to investigate the role of patient competencies in falls in the rehabilitation environment. In addition, little information was provided about whether proximate alarms were involved in “near-miss” falls. The results of the audit indicated that proximate alarms were not effective in preventing falls (see Section 6.4.2.3), but to properly interpret these results it would be useful to know whether any potential falls had been prevented by a proximate alarm being activated and staff arriving before the patient fell. No such events were reported in the falls records, but, as the saying goes, absence of evidence is not evidence of absence. The records used in this study did include some “near-miss” falls (most of which had been witnessed by staff), but it is unclear whether a fall prevented by a proximate alarm would have been classified as a “near-miss”.

6.5.3.2 The number of patient falls is only one aspect of patient safety

Patient falls are the most common type of adverse event in stroke rehabilitation (Holloway, Tuttle, Baird, & Skelton, 2007), which is why this was chosen as a quantitative indication of safety for this study. That being said, other safety concerns, such as medical errors and infection, can also occur in hospitalised stroke patients and these adverse events can lead to life-threatening complications for the patient and increased length of stay (Michaels et al., 2010; Ovbiagele, Hills, Saver, Johnston, & Investigators, 2006). The high falls risk does not discount the seriousness of these other adverse events. The falls audit in this study is best considered an investigation of patient falls in the rehabilitation environment, rather than a comprehensive study of patient safety.

In this study, patient falls have been considered in terms of total number, the number per patient, and the seriousness of the fall (i.e., whether they resulted in injury). The results of this study clearly indicate that the data for one facility can be skewed by one patient who falls multiple times (see Section 6.4.2.2). It is also clear that not all falls are equal in their consequences, and that most do not result in injury (see Section 6.4.1). Common metrics such as falls per bed days are not sensitive to multiple fallers or fall seriousness. Should a facility that reports many minor falls, but no injuries, be considered less safe than a facility that reports only one fall if that one fall resulted in serious injury? The way that falls are classified, categorised, and described has implications for calculations of risk and so may inform choices made by hospital administrators and planners about surveillance, restricted access, and other measures designed to promote patient safety.

6.6 Chapter summary

This chapter presented the quantitative results of a multiple-case study of two rehabilitation facilities in Victoria, including exploration of stroke patient activity, sleep, emotional well-being, and safety. The results of quantitative analysis and the cross-case comparison suggest that patient behaviour, emotional well-being, and safety vary depending on both internal factors (patient competencies) and external factors (physical environment). These quantitative findings will be revisited in the next chapter (Chapter 7) and merged with the qualitative findings from this multiple-case study, which were presented in Chapter 5.

7 Study 3: Mixed methods results of the multiple-case study

7.1 Chapter overview

This chapter is the last of the three chapters reporting the results of Study 3. In this chapter, the qualitative and quantitative results (which were outlined in Chapters 5 and 6 respectively) are merged using convergent mixed methods, as depicted in Figure 7.1. This analytic process addresses the primary aim of this thesis (see Section 1.6) and research question 3 of Study 3 (see Section 4.3): How do stroke patients' experiences of the physical environment of inpatient rehabilitation facilities, and the nature of their behaviour (activity and sleep), emotional well-being, and safety in these spaces help to explain the role of the physical environment of inpatient rehabilitation facilities in patients' behaviour, emotional well-being, and safety after stroke? The methods used to conduct the convergent mixed methods analysis were detailed in Section 4.10.4. The results from the convergent mixed methods analysis are presented in the first section of this chapter, culminating in a conceptual model of the role of the physical environment in stroke patients' behaviour, emotional well-being, and safety. The final section in this chapter provides a discussion of the strengths and limitations of the mixed methods multiple-case study methodology.

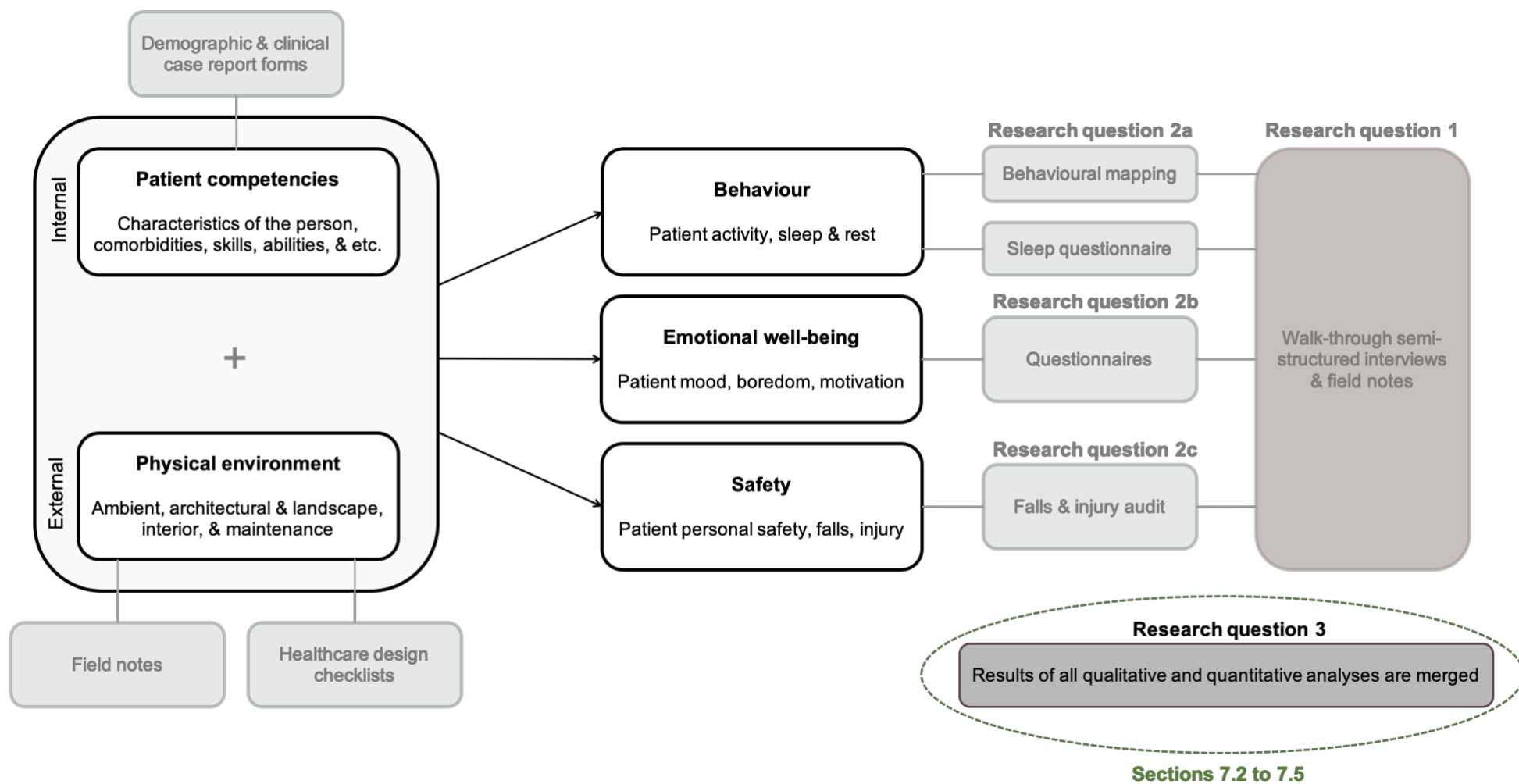


Figure 7.1 The results of Study 3 that are reported in Chapter 7.

This figure is adapted from Figure 4.2, in Chapter 4. Constructs are in white, qualitative data collection methods are in pink, quantitative measures are in blue, and mixed methods analysis is in purple. The results pertaining to research question 3 are reported in Chapter 7 as highlighted in the figure. The results addressing research questions 1 and 2 are reported in Chapters 5 and 6 respectively.

7.2 Merging the qualitative and quantitative findings

The convergent mixed methods analysis was facilitated by joint display tables in which the qualitative findings from the patient interviews (reported in Chapter 5) were placed adjacent to the quantitative findings from the behavioural mapping, questionnaires, and falls audit (reported in Chapter 6). The joint display tables provided a format by which to identify whether the qualitative and quantitative findings were congruent (i.e., agreed) with each other, divergent (i.e., differed) from each other, or unique (i.e., only qualitative or only quantitative findings available).

The contents of these joint display tables were organised according to topics drawn from important aspects of the qualitative and quantitative findings, as described in Section 4.10.4. These topics provided a common ground upon which to compare the findings from the two methodologies alongside each other in the joint display tables. To choose these topics, the research team considered the qualitative and quantitative findings closely, identified concepts relating to the environment that appeared in these findings, and organised these concepts into representative topics (as depicted in Appendix 20). The topics were:

- 1) Extended time spent in one location (namely, the bedroom);
- 2) The presence and absence of other people (in the bedrooms, hallways, and communal spaces);
- 3) Surveillance of patients by staff and/or technology;
- 4) Patients' sense of interest or fascination with the space and aesthetics;
- 5) Equipment, facilities, and technology;
- 6) Layout and orientation; and
- 7) Dimensions of the space.

7.2.1 ***Joint display tables***

Four joint display tables were completed – one for each of the constructs in research question 3 (activity, sleep, emotional well-being, and safety). These tables are presented below, followed by a narrative integration of the congruent, divergent, and unique findings. The results pertaining to activity are presented in Table 7.1, sleep in Table 7.2, emotional well-being in Table 7.3, and safety in Table 7.4.

Table 7.1 Comparison of the qualitative and quantitative findings that relate to patients' physical, cognitive, and social activity

Colour is used to link results pertaining to a particular subtopic across the qualitative, quantitative, and converged findings.

The following mark indicates no data: --

Topic	Qualitative findings	Quantitative findings	Convergence
Extended time spent in one location	Theme 1: Entrapment and escape - Participants at both cases felt that they spent too long in their bedroom (sub-theme 1.1). - They felt that going out of the bedroom and ward encourages more purposeful and beneficial activity (sub-themes 1.2 and 1.3). - Some participants responded by seeking out activity, but most responded with inactivity (sub-theme 1.1). - Participants at both cases desired more connection to the outside world (sub-themes 1.2 and 1.3).	Behavioural mapping - Participants at both cases spent majority of day in bedroom and visited few locations throughout the day (Figure 6.2 and Figure 6.3). - Participants at both cases were more active in other locations than in the bedroom (Figure 6.10). - Extent of activity varied widely between participants (Sections 6.2.2.3 and 6.2.4.10). - Participants at Case 1 rarely went outside and at Case 2 never went outside (Figure 6.2).	Congruent - Extended periods in bedroom. - More active outside of bedroom. - Some patients seek activity, some do not. Divergent - Patients want to go outside, but do not go outside.
Presence and absence of other people – bedrooms	Theme 1: Entrapment and escape - Participants at both cases felt that they spent too much time alone in their bedroom (sub-theme 1.1). Theme 3: The rehabilitation facility is a shared space - Shared bedrooms provide opportunity to be with others but can only lead to social interaction and support if roommates are able to interact (sub-theme 3.1).	Behavioural mapping - At both cases, participants were alone for ~1/3 of the day (Figure 6.10). - Participants in single-bed rooms appeared to spend more time alone, especially if had language and/or cognitive impairments (Section 6.2.2.2). - Participants with lang and/or cog impairments appeared to spend more time alone (Figure 6.4). - At both cases, and especially Case 2, the time that participants spent with others was more 'productive' (i.e., resulted in more social activity) in single- than shared bedrooms (Section 6.2.4.7). - Many variables may influence how much time spent alone, inc. roommates' impairments, position of beds, barrier between beds, and location of room (Section 6.2.4.6).	Congruent - Often alone in bedroom. - Less alone in shared bedrooms, but this does not necessarily translate to more social activity. - May be more alone if you or your roommate have language and/or cognitive impairments. Quantitative only - Being with others may result in more social activity in single-bed room than in shared. - Other variables besides number of beds in room may play a role in how much time patients spent alone in bedrooms.

Topic	Qualitative findings	Quantitative findings	Convergence
Presence and absence of other people – hallways	Theme 3: The rehabilitation facility is a shared space - Hallways provide opportunity for social activity (sub-theme 3.2). - The lounge nooks at Case 2 were used as a place to be private, but not alone (sub-theme 3.2).	Behavioural mapping - Social activity in hallways (Figure 6.10). - Hallways used differently at Case 2. Participants at Case 2 appear to spend more time in hallways, be more likely to be alone or with visitors when in hallways, and less likely to be active (Figure 6.8 and Figure 6.10).	Congruent - Hallways provide spaces for social activity. - Lounge nooks provide spaces to be private but not alone, not a space for activity.
Presence and absence of other people – communal spaces	Theme 3: The rehabilitation facility is a shared space - Participants want designated communal spaces so that they can be with other people (sub-theme 3.3). - Some participants saw no reason to go to the lounge if there's no one else there, others do not want the lounge to be too crowded (sub-theme 3.3).	Behavioural mapping Participants at both cases spend very little time in the communal spaces (Section 6.2.2.1).	Divergent - Patients want communal spaces but do not use those available. Qualitative only - The number of other people in communal spaces may play a role in whether these spaces are used.
Surveillance	Theme 2: Power, dependency, and identity in an institutional environment Bed alarms (Case 1) and being watched (Case 2) were perceived as punishments by some participants and made them feel they should stay in one place, thereby discouraging physical activity (sub-theme 2.1).	--	Qualitative only Surveillance may discourage activity.
Interest or fascination	Theme 1: Entrapment and escape Some participants at both cases found the environment uninteresting, which gave them no reason to leave the bedroom or the ward and so may	Behavioural mapping Patients may spend more time in bedrooms that are pleasant to be in (Section 6.2.4.1).	Congruent Interest and pleasantness may contribute to time spent in bedroom.

Topic	Qualitative findings	Quantitative findings	Convergence
	have resulted in more inactivity. Some participants at Case 2 found the bedrooms pleasant (sub-theme 1.1).		
Equipment, facilities, and technology	Theme 2: Power, dependency, and identity in an institutional environment - Participants at Case 1 felt personalising bedroom helped to spark social activity; harder to personalise shared bedrooms and all bedrooms at Case 2 (sub-theme 2.3). - Participants felt that physical barriers (e.g., locked doors, opening hours) indicated that they needed permission to leave their bedroom (sub-theme 2.3). Theme 4: The environment should be legible and patient-centred - Good quality, available therapy spaces and equipment facilitate practice (sub-theme 4.2). - Availability and accessibility of infrastructure (e.g., power plugs) and technology (e.g., touch screens) impact activity (sub-theme 4.2).	Behavioural mapping - Appears to be more social activity in the bedrooms in Case 2 compared to Case 1, even though harder to personalise bedrooms at Case 2 (Figure 6.10). Behavioural mapping - No dedicated Occupational Therapy spaces at Case 2 and appears to be less cognitive activity at this case (Figure 6.10 & Section 6.2.4.3).	Divergent - Personalising bedroom is not the only determinant of social activity. Congruent - Availability of therapy spaces may facilitate therapy. Qualitative only - Physical barriers may discourage activity. - Non-patient-centred infrastructure may discourage activity.
Layout and orientation	Theme 1: Entrapment and escape - Ward off ground level makes it harder to go outside but gives nice views from windows (sub-theme 1.3). Theme 3: The rehabilitation facility is a shared space - Communal spaces need to be positioned so that patients know they're available (sub-theme 3.3). Theme 4: The environment should be legible and patient-centred - Participants do not feel oriented to ward, so do not know where to go except bedroom (sub-theme 4.1).	Behavioural mapping Ward at Case 1 was closer to ground floor and patients appeared to spend slightly more time outside than at Case 2 (Figure 6.2).	Congruent - Distance to outdoor areas may impact whether they are used. Qualitative only - Out-of-the-way location of spaces may play a role in whether they are used. - Patients' orientation to the space may play a role in where they spend time.

Topic	Qualitative findings	Quantitative findings	Convergence
	• Circular layout of ward and wide hallways help with physical activity (sub-theme 4.2).		• Layout of ward and hallways plays a role in physical activity.
Dimensions of the space	Theme 3: The rehabilitation facility is a shared space • To facilitate social interaction, communal spaces need to be large enough to accommodate enough people without being crowded (sub-theme 3.3). Theme 4: The environment should be legible and patient-centred • Participants at Case 1 felt the large gym facilitates practice. Participants at Case 2 felt the small gym increases wait-times & makes it harder to practice in therapy (sub-theme 4.2).	Behavioural mapping • The pattern of activity in the therapy areas appeared to differ between cases; appeared to be more physical, cognitive, and social activity at Case 1 compared to Case 2 (Figure 6.10 and Section 6.2.4.3). • More crowded in therapy areas at Case 2 compared to Case 1 (Figure 6.7).	Qualitative only • Size of communal spaces may impact use. Congruent • Larger gym may facilitate therapy.

Table 7.2 Comparison of the qualitative and quantitative findings that relate to patients' sleep

Colour is used to link results pertaining to a particular subtopic across the qualitative, quantitative, and converged findings.

The following mark indicates no data: --

Topic	Qualitative findings	Quantitative findings	Convergence
Presence and absence of other people – bedrooms	Theme 3: The rehabilitation facility is a shared space - Participants suggested that noise in shared bedrooms could perhaps be decreased if the number of beds decreased (sub-theme 3.1). - Participants at both cases felt that noise interrupts sleep in both single and shared bedrooms; noise can come from adjoining rooms, staff entering the room, or talking in the hallways (sub-theme 3.1).	Sleep questionnaire: - Participants in single-bed rooms appear to report slightly worse sleep quality than participants in shared bedrooms (may have been due to differences in clinical profile) (Table 6.3). - At both cases, sleep was poor in both single and shared bedrooms (Table 6.3).	Divergent - Patients feel that sleep could be improved if number of beds was decreased, but quantitative results appear to indicate that sleep is impacted in single-bed rooms (which may be due to differences in clinical profile). Qualitative only - Noise from outside room interrupts sleep in both single and shared bedrooms. Quantitative only - Sleep is poor in both single and shared bedrooms.
Surveillance	Theme 2: Power, dependency, and identity in an institutional environment Participants at Case 1 commented that bed alarms interrupt sleep (sub-theme 2.1).	--	Qualitative only Bed alarms may interrupt sleep.
Equipment, facilities, and technology	Theme 3: The rehabilitation facility is a shared space Noise can come from equipment, facilities, and technology in the environment (e.g., banging doors or alarms from nurse call-bells) (sub-theme 3.1).	--	Qualitative only Ambient noise from equipment, facilities, and technology may interrupt sleep.

Table 7.3 Comparison of the qualitative and quantitative findings that relate to patients’ emotional well-being
 Colour is used to link results pertaining to a particular subtopic across the qualitative, quantitative, and converged findings.
 The following mark indicates no data: --

Topics	Qualitative findings	Quantitative findings	Convergence
Extended time spent in one location	Theme 1: Entrapment and escape - Describe feeling bored and trapped in time and space (sub-theme 1.1). - Sense of entrapment motivated some people towards recovery, others feel despondent (sub-theme 1.1). - Connection to outside world (other people, views), variety & change, & purposeful activities help to alleviate entrapment & boredom (sub-theme 1.2). - Spending too long in one room or too much time alone contributes to low mood, feel stuck (sub-theme 1.1). - Leaving the ward can relieve boredom and provide motivation, even if do not leave the hospital (sub-theme 1.3).	Boredom questionnaire (MSBS) - MSBS scores appear to be similar to population norm but ‘Time perception’ subscale differed from population norm (Table 6.5 and Section 6.3.5.2). Motivated by environment questionnaire (VAS) - Some participants at both cases felt very motivated by the environment, others did not (Section 6.3.1.3).	Congruent - Feel trapped in time & space. - Some patients feel motivated by the hospital environment, others do not. Divergent - Describe feeling bored, but MSBS scores similar to non-hospitalised population. Qualitative only - Connection to outside world, sense of variety & change, & purpose are important for emotional well-being. - Emotional well-being may be negatively impacted by extended time alone in bedroom. - Leaving ward can be motivating.
Presence and absence of other people – bedrooms	Theme 3: The rehabilitation facility is a shared space - Privacy is difficult to find on the ward – even single-bed rooms can lack privacy (sub-theme 3.1). - Participants want privacy in the bedroom, but do not want to feel isolated (sub-theme 3.1). - Roommates can provide emotional support, but only if they are cognitively able. If roommate is	Mood questionnaire (DASS) Cross-case comparison indicated that other factors besides the number of beds in the room played more of a role in participants’ mood (Section 6.3.5.4).	Congruent Other factors besides the number of beds in the room may play a more important role in participants’ mood and motivation; not necessarily better in single or shared bedrooms, both can lack privacy.

Topics	Qualitative findings	Quantitative findings	Convergence
	cognitively unable then participant may feel frustrated or responsible for them (sub-theme 3.1).	Boredom questionnaire (MSBS) - At both cases, participants in single-bed rooms appear to experience more boredom than participants in shared bedrooms (Figure 6.15). Motivated by environment questionnaire (VAS) - Motivation varied widely in single and shared rooms at both cases (Figure 6.17). Cross-case comparison suggests that other factors besides the number of beds in the room may play a more important role in motivation (Section 6.3.5.4).	Quantitative only - Appear to be more bored in single-bed rooms. Qualitative only - Distinction between privacy and isolation. - Impact of roommate on emotional well-being depends on their cognitive abilities.
Presence and absence of other people – hallways	Theme 1: Entrapment and escape - Seeing other people passing in hallway helps participants to feel less alone (sub-theme 1.2). Theme 3: The rehab facility is a shared space - Seeing patients in hallways & therapy can be upsetting but also motivating (sub-theme 3.2). - The lounge nooks at Case 2 allow for privacy, without feeling isolated (sub-theme 3.2).	--	Qualitative only - Hallways provide opportunity to see other people which can play a role in emotional well-being. - Lounge nooks are private but not isolated spaces.
Surveillance	Theme 1: Entrapment and escape - Bed alarms are frustrating (sub-theme 1.1). Theme 2: Power, dependency, and identity - Surveillance prompts feelings of lack of privacy and lack of autonomy; can be perceived as punishment or lack of trust (sub-theme 2.1).	--	Qualitative only Surveillance may cause frustration and lack of privacy, prompt feelings of powerlessness.

Topics	Qualitative findings	Quantitative findings	Convergence
Interest or fascination	Theme 1: Entrapment and escape - Some participants feel there's nothing interesting in the environment (sub-theme 1.1). - Changes outside window provide variety, distraction, & sense of progress; help motivation & boredom (sub-theme 1.2). - Outside helps with boredom (sub-theme 1.3). Theme 2: Power, dependency, and identity - Visual & aural aesthetics can help or hinder well-being. Some find clinical aesthetic dull & boring (want colour), others find it motivating or reassuring (sub-theme 2.2).	--	Qualitative only - Variety and change in environment (e.g., going outside or seeing outside) may help with mood, boredom, and motivation. - Ward aesthetics may help emotional well-being for some, hinder for others.
Equipment, facilities, and technology	Theme 2: Power, dependency, and identity in an institutional environment - Personalised bedroom has implications for control; harder to personalise shared bedrooms and all bedrooms at Case 2 (sub-theme 2.3). - Sense of ownership in gym can be motivating (sub-theme 2.3). Theme 4: The environment should be legible and patient-centred - Purposeful, modern therapy equipment provides motivation (sub-theme 4.2). - Lack of equipment, lack of maintenance, or equipment designed for patients that cannot be used by patients can be frustrating and a reminder of dependency (sub-theme 4.2).	--	Qualitative only - Sense of ownership in bedroom is important for some patients' sense of control, should be a consideration in all bedrooms (both single and shared). - Sense of ownership over equipment, facilities, and technology can be motivating. - Equipment, facilities, and technology can be motivating, but they can become a reminder of dependency if they are unmaintained or lacking.

Topics	Qualitative findings	Quantitative findings	Convergence
Layout and orientation	Theme 1: Entrapment and escape - Seeing other people out a window helps participants to feel connected with the outside world & less alone (sub-theme 1.2). Theme 3: The rehabilitation facility is a shared space - Bedroom location away from communal hubs linked to isolation (sub-theme 3.1). Theme 4: The environment should be legible and patient-centred - Participants unaware of location & existence of key spaces so feel lack of control and lack of autonomy; information about the environment can help with orientation (sub-theme 4.1). - Harder to feel oriented without landmarks on the walls at Case 2 (sub-theme 4.1).	--	Qualitative only - Layout that facilitates connection with others (e.g., proximity to communal hubs or window with a view of people) may be beneficial for emotional well-being. - Layout and information may play a role in how orientated patients feel to the space and subsequently their sense of control. - Aesthetics may play a role in how oriented patients feel in a space.
Dimensions of the space	Theme 1: Entrapment and escape - Large rooms and large windows help some patients to feel less trapped, but not others; feelings of entrapment persisted at Case 2 despite the larger rooms and larger windows. (sub-theme 1.1). Theme 4: The environment should be legible and patient-centred - Wide hallways provide motivation (sub-theme 4.2).	--	Qualitative only - Larger rooms, windows, and hallways may help with emotional well-being. - Large rooms and windows do not eliminate sense of entrapment.

Table 7.4 Comparison of the qualitative and quantitative findings that relate to patients' safety

Colour is used to link results pertaining to a particular subtopic across the qualitative, quantitative, and converged findings.

The following mark indicates no data: --

Topic	Qualitative findings	Quantitative findings	Convergence
Extended time spent in one location	Theme 1: Entrapment and escape Entrapment prompted some participants to seek out stimuli and so may be a safety risk (sub-theme 1.1).	Retrospective falls record At both cases, most falls occur in the bedroom (Section 6.4.1).	Congruent Extended time in bedroom detrimental to safety.
Presence and absence of other people	Theme 2: Power, dependency, and identity in an institutional environment - Patients feel safer if they know staff will be there to help when needed (sub-theme 2.2). Theme 3: The rehabilitation facility is a shared space - Want privacy in bedroom, but do not want to feel isolated; can feel unsafe if isolated (sub-theme 3.1). - Roommates help each other (sub-theme 3.1).	Retrospective falls record - At both cases, the majority of the reported falls occurred when a staff member was not present (Section 6.4.1). - Most falls occur when staff not present (Section 6.4.1).	Congruent - Isolation may be detrimental to safety. - May be safer if patients can readily contact staff. Qualitative only - Roommates may be beneficial for safety.
Surveillance	Theme 2: Power, dependency, and identity in an institutional environment Surveillance may prompt some participants to sneak out or self-discharge (sub-theme 2.1).	Retrospective falls record Details from Case 1 indicate that proximate alarms and sensor mats are unreliable (Section 6.4.1).	Congruent Surveillance may be detrimental to safety, or at least, not beneficial.
Equipment, facilities, and technology	Theme 4: The environment should be legible and patient-centred Nurse call-bell can help patients to feel safe but is unreliable if out of reach; things in the bedroom are inconveniently placed (sub-theme 4.2).	Retrospective falls record - Some staff respond to falls risk by adjusting equipment and facilities to make patient-centred (e.g., adjust angle of chair) (Section 6.4.1). - Reaching for objects can lead to falls (Section 6.4.1).	Congruent - Patient-centred equipment and facilities may aid safety. - Inconvenient environment may hinder safety.

Topic	Qualitative findings	Quantitative findings	Convergence
Dimensions of the space	--	Retrospective falls record • Appeared to be more falls in the bathrooms at Case 2 compared to Case 1, and bathrooms at Case 2 were noticeably larger (Section 6.4.1).	Quantitative only • Larger rooms may be detrimental to safety if no handholds provided.

7.2.2 *Narrative integration of the congruent, divergent, and unique findings*

The multiple steps and iterative comparisons involved in developing the joint display tables aided the interpretation of the data. Congruency between the qualitative and quantitative data in the joint display tables helped to confirm findings, and the divergent and unique data helped to explain findings, expanding on the congruent results. In this section, the merged results from the joint display tables are woven together with past research in a narrative integration.

7.2.2.1 *Variety and interest in the environment*

Qualitative and quantitative findings suggested that patients spend extended periods of time in one, unchanging environment – their bedroom – and that this may have negative implications for their activity, emotional well-being, and safety (see ‘Extended time spent in one location’ in Table 7.1, Table 7.3, and Table 7.4).

Our findings indicate that feelings of entrapment persist regardless of room size and that a key means of providing a distraction from boredom or low mood is to spend time in more than one location, namely, get patients out of their bedroom. This could also benefit patients’ safety, since most falls occur when patients are alone in their bedroom. Our findings reveal a disconnect between patients’ desires to leave their bedroom, and their actual behaviour. Part of the reason for this disconnect is that patients feel there is nothing of interest outside their bedroom (see ‘Interest and fascination’ in Table 7.1). The term ‘fascination’ is used in environmental psychology to describe the calm engagement and desire to explore that people feel in response to information-rich natural or architectural environments (Coburn et al., 2020; Kaplan, 1995). In healthcare design specifically, the term ‘positive distraction’ has been used

to describe the aesthetic qualities in the environment that patients may find pleasant and interesting (Ulrich, 1991). There is some evidence that positive distractions such as art and nature may lower stress (Ulrich, 1991), reduce depression (Staricoff & Loppert, 2003), reduce pain medication, and lower heart rate and blood pressure for patients in hospital (Ulrich & Gilpin, 2003). The question was raised in the introduction of this thesis as to how a building itself could become a more enriched environment, rather than relying on the addition of games or activities into the space (see Section 1.4.2). Our findings begin to answer this question by suggesting that increasing the richness and interest of areas outside the bedroom may encourage patients to explore these spaces, thereby helping them to experience a more varied and interesting environment, encouraging activity and supporting emotional well-being.

Findings from the qualitative interviews indicate that what constitutes an interesting environment (or a fascinating environment, or a positive distraction) may vary between patients – aesthetics that are uplifting and engaging for some patients may feel depressing and institutional for others (see ‘Extended time in one location’ and ‘Interest and fascination’ in Table 7.3). Versatility (as defined in Section 3.3) in the rehabilitation environment is therefore key in order to accommodate all tastes and create interest and incentives for all patients to explore beyond their bedroom (flexibility was also highlighted in Study 2 of this thesis, see Section 3.3). Interior design could, for example, provide built-in options for a space to be either bright and colourful or neutral and soft depending on the preferences of the patient.

Variation and changes in the environment over the course of a day may have the additional benefit of helping to mark time in what is apparently otherwise quite a static existence for patients. There is evidence that natural light during the day and

darkness at night, or lighting that mimics natural circadian rhythms, is beneficial for patients' sleep in hospital (Gharaveis, Shepley, & Gaines, 2016). In addition to promoting sleep, perhaps light changing over the course of the day could also provide variation, interest, and a marking of time in the environment, and thus combat boredom.

7.2.2.2 Allowing for privacy without isolation

Our findings concerning the presence and absence of other people in the environment illustrate that the physical environment and social activity are linked (which harks back to the interconnections between the physical and social environment mentioned in the introduction, see Section 1.3); there are many aspects of the physical environment that may play a role in how the presence or absence of other people impact patient behaviour, emotional well-being, and safety. The merged results suggest that being around other people (or at least having visual connection) is important, even when it does not result in social activity, but that patients also appreciate a sense of privacy (see 'Presence and absence of other people – bedrooms, – communal spaces, and – hallways' in Table 7.1, Table 7.2, Table 7.3, and Table 7.4). This dual need for both connection and privacy in stroke facilities has been raised in previous research (Anåker et al., 2019). To better describe this dual need, a distinction is made here between a) feeling alone or isolated (defined as an awareness that there are no other people in close physical proximity), b) feeling lonely (defined as feeling unable to engage or connect with other people), and c) feeling a sense of privacy (defined as feeling that one has control over whether other people have access to one's personal space, thoughts, feelings, and information about one's person).

Connection with other people provided variety and interest for patients (which, as discussed in the previous section, was otherwise lacking) and it also helped

to combat loneliness. It is well established in the literature that patients in rehabilitation, and especially in single-bed rooms, may feel lonely (Gill, Hogg, & Dolley, 2016; Maben et al., 2016; Persson, Anderberg, & Kristensson Ekwall, 2015; Shannon et al., 2018). Our findings echo this, but further suggest that many other factors, besides the number of beds in the room, may also play a role in patients' experience of loneliness, and also their social interaction and sleep. These include internal factors, such as the impairments experienced by the patient and/or their roommate, and external factors, such as the position of the beds in the room, the type of barriers between beds, noise outside the bedroom, the location of the bedroom relative to communal hubs, and the size and location of communal spaces. Having another person in the room is not sufficient to prevent loneliness, nor is it sufficient to promote social interaction.

Similarly, being alone is not synonymous with feeling a sense of privacy. Some patients in single-bed rooms experienced a lack of privacy, especially those who had to share a bathroom, and some patients sought out places where they could be private, but not alone (e.g., cafes, the waiting area in a downstairs hallway where roommates went to talk in Case 1, and the lounge nooks in Case 2). These spaces would normally be classified as public spaces, but for many reasons including e.g., ambient noise, layout, and perhaps a certain degree of anonymity for the patient, the patients considered these spaces to be more private than their bedroom.

Privacy has long been acknowledged as an important issue in health care ethics (Beauchamp & Childress, 2001), but there is no unified definition of what constitutes privacy in this context (Leino-Kilpi et al., 2001). The definition adopted in this thesis (stated in the first paragraph of this section) draws from Altman's definition of privacy, which emphasises the importance of one's volition and control

over whether other people have access to one's self (1976), and Burgoon's definition, which emphasises that privacy is about more than just proximity to others, it is also about choosing whether to interact, and about the sharing of personal thoughts and information (1982).

Privacy in the healthcare environment is about more than just the issue of single versus shared bedrooms, it is also about where and how staff conduct consultations or discuss confidential patient information (which unfortunately sometimes happens in public spaces, see Section 5.2), and it is about whether patients feel that they have a 'territory' or personal space (akin to the concept of ownership, see 'Equipment, facilities, and technology' in Table 7.3) (Leino-Kilpi et al., 2001; Serenko & Fan, 2013; Tehrani et al., 2018). In addition, the extent to which patients feel their privacy is being respected may also influence how much they trust staff, and subsequently how much they communicate and disclose during consultations (Tehrani et al., 2018). This provides further evidence for the importance of designated therapy spaces (see 'Equipment, facilities, and technology' in Table 7.1), and it also has implications for our findings regarding surveillance, which suggest that patients feel that surveillance is an invasion of their privacy, that it makes them feel powerless and frustrated, and that it jeopardises the trust between patient and staff (see 'Surveillance' in Table 7.3).

The issue of surveillance illustrates the distinction between wanting to be private and wanting to be alone. Although patients were wary of surveillance, many of them also recognised that they were safer if they were not alone, and indeed, many falls could have been avoided if patients had been able to ask a staff member to help them to the bathroom or to pick up an object. The physical environment and technology in hospital should be designed to allow reasonable monitoring from staff

and a reliable means of contacting staff, without compromising privacy. The difference between desired monitoring from staff and surveillance is patient volition.

There are examples in our findings of how a flexible physical environment can allow for patient choice and provide a private, but not isolating, space. The lounge nooks in Case 2, for example, were tucked-away enough to feel private and to provide the opportunity for relative solitude but were also large and central enough to provide the opportunity to observe other people, interact, and feel safe. These principles of flexibility and choice could be applied to the design of all spaces in which patients spend time. Perhaps if patient bedrooms, for example, were designed with these principles in mind then a design solution could be achieved that incorporates all the benefits of both single and shared bedrooms.

7.2.2.3 Patient-centred design

The stated aim of patient-centred healthcare design is to facilitate patient-centred care, meet the needs of the patient, and allow for patient choice and control over the environment, but there is no consensus about what exactly is important in the design of the physical environment for achieving these aims (patient-centred design was initially described in the introduction to this thesis, see Section 1.4.1).

Our merged results do suggest that meeting patient needs and allowing for patient choice and control are important, but it is also clear that simply providing for patient needs and having options available does not guarantee that patients will be able to exercise an informed choice or exert control. For example, the merged results indicate that patients need communal spaces, but that simply having these spaces available is not sufficient to fulfilling this need (see ‘Presence and absence of other people – communal’ in Table 7.1). There were a number of reasons why patients did not use the communal spaces that were available, including: not knowing that they

existed, feeling that they were too crowded, not knowing where they were located, feeling that they were difficult to access, and feeling that they did not have permission to use them (see ‘Layout and orientation’ and ‘Surveillance’ in Table 7.1 and Table 7.3). These results, and other similar results in the joint display tables, suggest that at least three criteria need to be met in order to properly meet patients’ needs and give them choice and control over their environment:

- 1) Provision: Appropriate options that respond to patient needs have to be provided (e.g., communal spaces have to exist, must be of appropriate size, and must include all necessary equipment such as chairs, books, etc.),
- 2) Coherence: Patients need to know that these options are there and understand how to access them (e.g., the communal space has to be in an obvious location, be easy to find, and patients need to be given this information), and
- 3) Convenience: Patients need to be able to access these options easily and conveniently (e.g., the communal space has to be easy for the patient to get to, and easy to enter) – this will help to remind the patient that they have the right to choice and control in the environment.

If an environment only achieves ‘Provision’ of options, then patients are technically being offered a choice, but they are not being offered an *informed* choice (because they do not necessarily understand that there is a choice to make or what they are choosing between – that is, the options are not coherent), and they are not being offered a *fair* choice (because some options are more convenient for the patient to access than others). The term ‘coherence’ was proposed by Kaplan to describe how easily information in an environment is processed (1995). He suggested that the

reason that people feel restored and relaxed when in nature is because we find these environments both fascinating (interesting/engaging) and coherent (easy to understand) (Kaplan, 1987, 1995). Coburn et al. have since described the importance of both fascination and coherence in our response to architectural scenes (2020).

The three criteria above can be applied to any question of patient-centred design, besides that of communal spaces. For example, the safety audit in our study revealed a need for more surfaces in the bedroom so that patients could place items within reach. In order to meet this need, the extra surfaces would need to be provided (Provision), they would need to be designed and maintained in such a way that made it obvious what they were for (Coherence), and they would need to be placed in a position that was convenient for the patient, or be convenient for them to adjust or move (Convenience).

Our findings help to define a patient-centred rehabilitation environment as one that provides everything the patient needs in such a way that is coherent and convenient for the patient, thereby enabling them to exercise informed choice and control over their environment. Environments that provide only the means to meet patient needs, without making these means coherent or convenient for the patient, risk becoming detrimental to patient behaviour, emotional well-being, and safety, rather than beneficial (see, for example, the observations regarding the placement of timetables, locked doors to balconies, and etc. in Theme 4, Section 5.4).

7.3 A conceptual model of the role of the environment in patient behaviour, emotional well-being, and safety

In this section, the results of the convergent mixed methods analysis are crystallised into three environmental principles for stroke rehabilitation and interpreted using Person-Environment Fit theory to create a conceptual model of the role of the physical environment of rehabilitation facilities in patients' behaviour, emotional well-being, and safety after stroke (thereby addressing research question 3, and the primary aim of this thesis).

7.3.1 *Three environmental principles for stroke rehabilitation*

The narrative integration in the previous section emphasised three main environmental principles that appear to play a role in stroke patient behaviour, emotional well-being, and safety: 1) variety and interest in the environment, 2) allowing for privacy without isolation, and 3) patient-centred design (see Figure 7.2). The results imply that patient behaviour, emotional well-being, and safety will be supported if the physical environment of rehabilitation facilities is designed according to these three environmental principles. Specifically, our findings suggest that Principle 1 (variety and interest in the environment) plays a role in patient activity and emotional well-being, an indirect role in patient safety (by encouraging patients to spend time outside their bedroom), but no apparent role in patient sleep. Principles 2 and 3, however, appear to play either a direct or indirect role in all of the patient objectives that were considered in this study: behaviour (activity and sleep), emotional well-being, and safety.

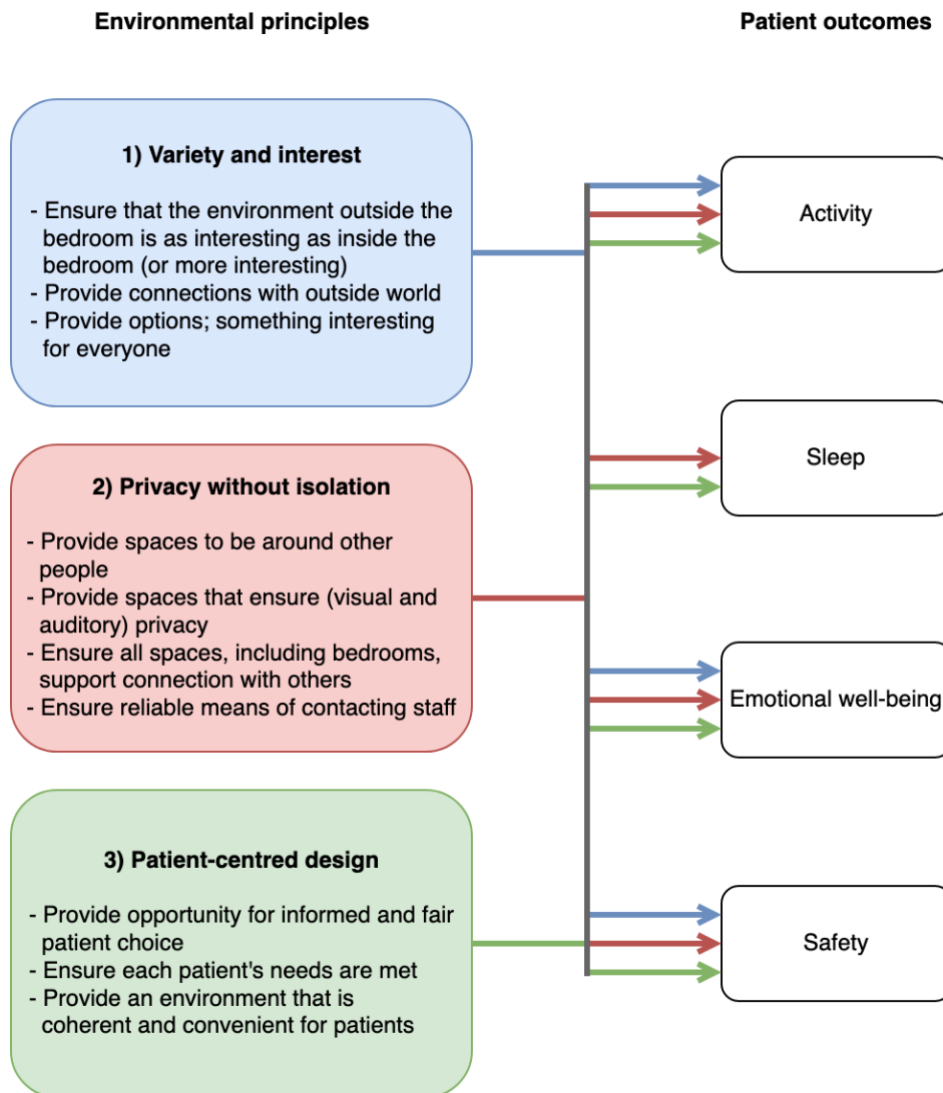


Figure 7.2 A conceptual model of the environmental principles that play a role in patient behaviour (activity and sleep), emotional well-being, and safety in stroke rehabilitation.

7.3.2 *Applying these principles in practice*

The three environmental principles could be applied to all aspects or features of the physical environment of rehabilitation facilities, including ambient features, architectural and landscape features, interior design features, and maintenance and housekeeping. To give an example, Figure 7.3 shows how these three environmental principles could be used to inform the architectural and interior design features of the

communal lounge room. If all three environmental principles are applied, then a possible design outcome could be ‘graded’ communal spaces that begin just outside the patients’ bedrooms. There could, for example, be: 1) a small gathering space immediately outside the bedroom that is shared between one or two bedrooms and that includes some resources that promote cognitive activity (e.g., books), this would connect to 2) the larger communal hallway, with some seating provided, and off this hallway could be 3) a more conventional communal lounge for larger gatherings and with more extensive resources for cognitive activity (e.g., computers, tablets, etc.).

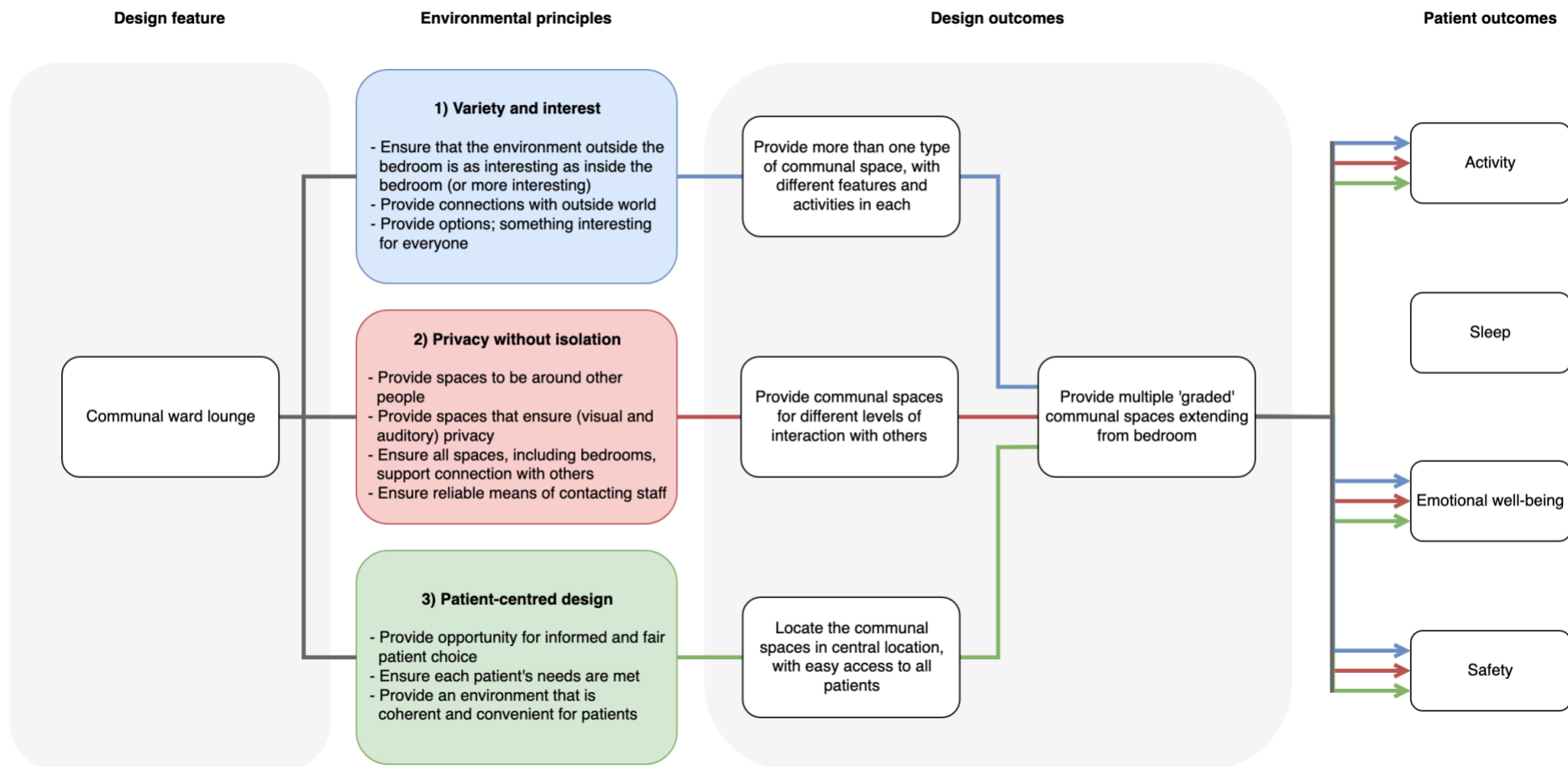


Figure 7.3 An example of how the conceptual model could be used to inform the design of communal spaces in stroke rehabilitation.

Figure 7.4 shows the same conceptual model as Figure 7.3 but applied to the interior design feature of power socket placement. In this example, Principle 2 (allow for privacy without isolation) does not directly influence the design outcome, but it is arguably still relevant for this design feature as the very existence of power sockets may determine how easy it is for patients to charge the personal devices that allow them to connect with family and friends and thus combat loneliness. These two examples (in Figure 7.3 and Figure 7.4) illustrate how any design feature, however large or small, could be considered using these three principles and thereby support patient behaviour, emotional well-being, and safety.

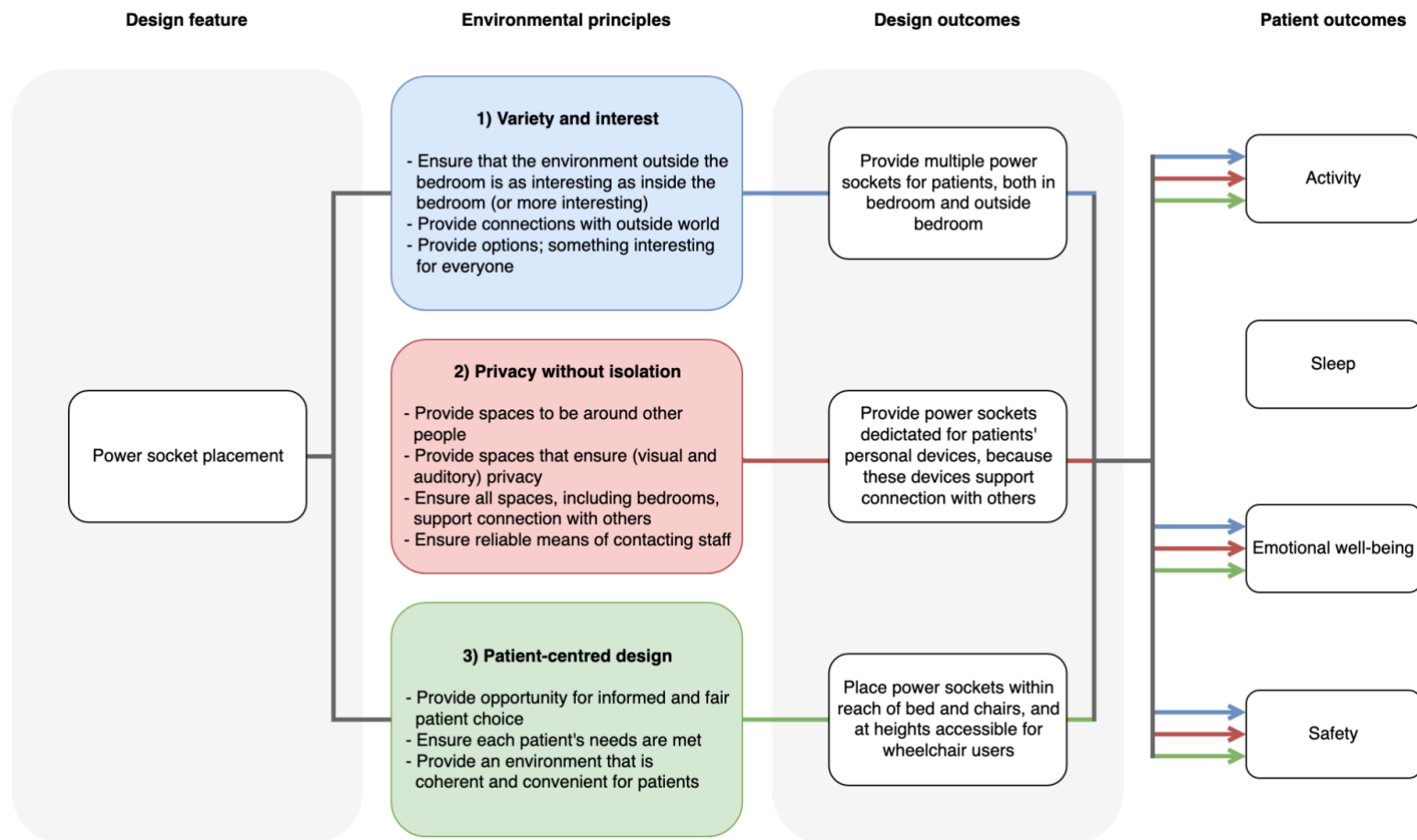


Figure 7.4 An example of how the conceptual model could be used to inform power socket placement in stroke rehabilitation.

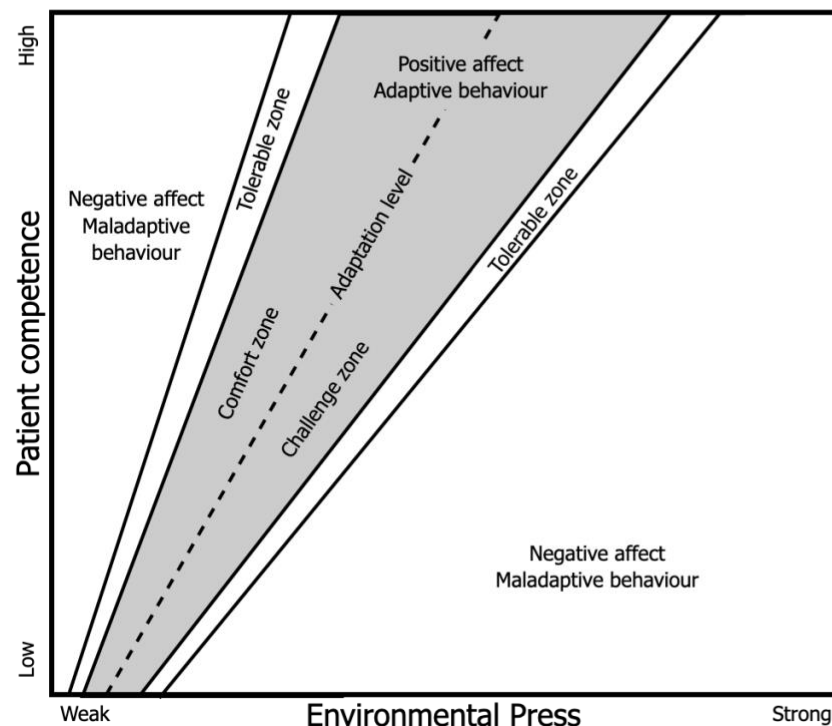
7.3.3 *Interpreting the conceptual model in the context of Person-Environment Fit theory*

According to Person-Environment Fit theory, all aspects of an environment can exhibit environmental press, that is, they can place demands or supports on a person in the context of a particular action or task (Lawton & Nahemow, 1973). All environmental features are themselves neutral, but they can produce positive or negative press when they interact with a person's competencies (see definition of environmental press in Section 1.3.2). Person-Environment Fit theory proposes that a person's behaviour and emotional well-being will vary according to the fit between the person's competencies (internal factors) and the environmental press (external factors). If there is a good fit between the person's competencies and the environmental press, then the person will exhibit positive affect and adaptive behaviour. When this occurs, the environmental fit is said to be within the adaptive, or comfort and challenge zone. If there is a lack of fit between the person's competencies and the environmental press, then the person will exhibit negative affect and maladaptive behaviour and the environmental fit is said to be in the maladaptive zone.

The results of the present study do indeed indicate that stroke patients' behaviour and emotional well-being vary depending on patient competencies and the environment (see, for example, Table 6.2 on page 211 and Figure 6.12 on page 228). This suggests that Person-Environment Fit theory can be applied to stroke rehabilitation environments. The findings of this study, and the resulting conceptual model described in the previous section, suggest that if rehabilitation environments are designed according to three environmental principles (variation and interest, privacy without isolation, and patient-centred design) then all the features in the

environment will produce a more appropriate level of demand and support (i.e., a more appropriate level of environmental press) for stroke rehabilitation patients, thereby extending the adaptive zone for patients of all competencies (see Figure 7.5).

A. Environmental principles for rehabilitation design not realised



B. Environmental principles for rehabilitation design realised

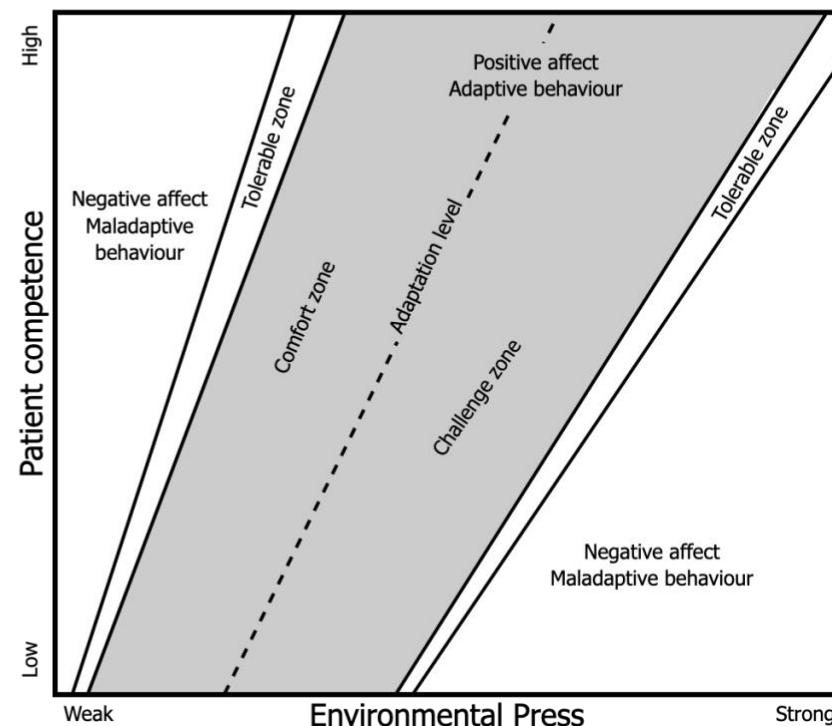


Figure 7.5 Person-Environment Fit in rehabilitation environments.

Figure A is identical to Figure 1.2 (which was in Chapter 1 of this thesis). Figure B illustrates that rehabilitation environments designed according to three environmental principles (variation and interest, privacy without isolation, and patient-centred design) may produce a more appropriate level of environmental press for stroke rehabilitation patients, thereby extending the zone of positive affect and adaptive behaviour. Figure is adapted from Lawton and Nahemow (1973, p. 661).

7.3.4 ***The importance of a flexible environment***

Person-Environment Fit theory proposes that people with low competence have a narrower adaptive zone, while people with high competence can tolerate a wider range of press in their environments (see Figure A in Figure 7.5). This would appear to imply that rehabilitation environments should be designed to fit the competencies of the most impaired patients, e.g., if communication supports are designed into the environment then these will support patients with communication impairment without impacting those without these impairments. However, Person-Environment Fit theory also predicts that negative affect and maladaptive behaviours may occur if a person's competencies far exceed the environmental demands (low environmental press, high competence), which suggests that if communication supports, for example, did dominate the environment then this may in fact lead to negative affect and maladaptive behaviour for people who do not need these supports. What is required is versatility in the environment so that the appropriate environmental demands or supports can be accessed by each patient.

The term 'versatility' was defined in Section 3.3 as the component of flexibility that describes the ability of the environment to change over the short term in response to immediate needs. This was distinguished from 'adaptability' which is the type of flexibility that describes a building's ability to change over the long or mid-term and be 'future-proof'. In the literature, flexibility is usually discussed in the context of the long-term economic and operational needs of the healthcare service and administrators (Carthey, Chow, Jung, & Mills, 2011), akin to the concept of adaptability as it is defined here. This chapter, however, is concerned with short-term flexibility and the variety and choice that a versatile environment can provide for patients specifically. The three environmental principles identified in this study all

encapsulate the need for versatility, options, and choice that respond to the needs of the patient. If all of these principles are realised, then the resulting physical environment would be a flexible space that can be adjusted for patients of different competencies and as an individual patient's competencies change over the course of a day, week, or month, as is expected in rehabilitation. It is due to this flexibility that the zone of positive affect and adaptive behaviour can become wider for all patients, regardless of their competencies (see Figure B in Figure 7.5), and thereby support the behaviour, emotional well-being, and safety of each patient in the rehabilitation environment.

Importantly, although the adaptive zone is wider for all patient competencies in Figure B, this model acknowledges the possibility that some patients of high or low competencies may still experience negative affect or maladaptive behaviour even if all the environmental principles are realised (see Figure 7.5). The outliers that were observed in this study (see, for example, Figure 6.2, page 196) illustrate that each stroke patient is different and will have unique needs. It is worth acknowledging that even the most flexible, optimally designed physical environment may not produce optimal demands or supports for all patients all the time. Stroke rehabilitation is, after all, a *process* of learning and recovery and this process may involve some periods of negative affect or maladaptive behaviour as the patient re-learns old skills or abilities or learns new skills to adjust to the impairments that they experienced as a result of the stroke.

7.4 Discussion

This chapter presented the convergent mixed methods results of a multiple case study of two inpatient stroke rehabilitation facilities in Victoria, Australia. The

results of this study were discussed in the context of previous literature in Sections 7.2.2 and 7.3 above. This present section contains a proposal of how the conceptual model that was developed in this study could be tested in future research, followed by a discussion of the strengths and limitations of the convergent mixed-methods methodological approach.

7.4.1 *How to test the conceptual model*

The conceptual model in Figure 7.5 above could be tested in future research by assessing whether stroke patient behaviour and affect varies depending on the extent to which the three environmental principles are realised. Based on this model, one would hypothesise that stroke patients in environments where the three environmental principles are well-realised will exhibit more adaptive behaviours and positive affect than patients in environments where the environmental principles are not well realised. One could also hypothesise that the extent of adaptive behaviours and positive affect will increase as patient competency increases, but that some patients of all competencies will exhibit maladaptive behaviours and negative affect in all environment types. Patients with a wide range of competencies (i.e., a range of stroke severities and impairments) would need to be included in all of the environments under study.

Many methodologies could be used to compare between such environments, ranging from experimental methods (e.g., comparing patient behaviour and affect in different mock-wards or virtual environments) to observational methods (e.g., comparing patient behaviour and affect between existing, real-world rehabilitation facilities). The various strengths and limitations of such methodologies will be discussed further in Section 8.4, Chapter 8. Regardless of the methodology that is used, a measure would need to be developed to assess whether the three

environmental principles are realised. Without such a measure, there would be no way to articulate the extent to which the environment being studied offers variety and interest, privacy without isolation, and patient-centred design.

Such a measure could take the form of a checklist or audit tool designed to be completed by someone familiar with the environment in question (see Section 5.5.4.1), or it could take the form of a questionnaire designed to be completed by patients. Both approaches would have their benefits and limitations. Whichever measurement approach is taken, a series of focus groups, piloting, and validation studies would be required in order to ensure that the new measure accurately assesses the extent to which a rehabilitation environment provides variation and interest, privacy without isolation, and patient-centred design.

Understanding patients' perception of the environment is key to determining whether each of the environmental principles have been realised, so a patient-reported measure would be most appropriate in that respect. If the patient-reported measure was well-developed and valid (e.g., following a process similar to that recommended by Ottosen, Engebretson, & Etchegaray, 2017), then gathering responses from many patients at each facility would give a more accurate and un-biased representation of the extent to which the three environmental principles are realised than what could be generated from a checklist or audit tool completed by one person. In order to overcome the limitations of conducting questionnaires with stroke patients (see Section 6.5.1.2), any patient-reported measure would need to be short and easy to complete. Simple questions could be developed to address each of the environmental principles. For example, asking patients whether or not they know the location of the lounge room could address the principle of patient-centred design. The measure could

also be developed to be completed by either the patient or a family member/friend proxy.

The benefit of a checklist, on the other hand, is that it would not require patient input and so would avoid issues of data completeness and participant burden. In addition, a checklist would only be completed once per facility, or perhaps twice per facility to check inter-rater reliability, enabling a much larger sample of environments to be collected. Ultimately, the appropriateness of either measurement tool would depend on the specific research questions and the research method that was chosen. Possible applications for both a checklist or audit tool will be discussed further in Section 8.4, Chapter 8.

7.4.2 *Convergent mixed methods*

The qualitative and quantitative components of this study produced valuable findings (see Chapters 5 and 6), but it was only in the merging of these two sets of findings that a conceptual model could be developed to describe the role of the physical environment in stroke patient behaviour, emotional well-being, and safety in rehabilitation. The convergent mixed methods approach therefore provided greater insights and a deeper understanding of this complex topic than either the qualitative or quantitative methods did alone.

7.4.2.1 *Parallel collection of qualitative and quantitative data*

The qualitative and quantitative data for this mixed-methods study were collected in parallel (as described in Section 4.4). This had a number of benefits. The most obvious of which was that the same participants could contribute to both data types, which helped to facilitate the merging of the results (Creswell & Plano Clark, 2018). The qualitative and quantitative results pertaining to safety were surprisingly

congruent with each other considering that they came from different samples (see Table 7.4).

I was wholly unfamiliar with rehabilitation environments when I commenced this PhD, which gave me the benefit of an unbiased perspective, but this also made it all the more necessary to spend time familiarising myself with the environment prior to data collection. A benefit of the parallel data collection was that the time that I spent collecting the quantitative data could contribute to the quality of the qualitative data. That is, conducting the behavioural mapping and administering the questionnaires gave me time to become familiar with the building and participants' behaviour, and to build a rapport with participants, and thus contributed to my field notes and informed the questions that I asked in the walk-through semi-structured interviews.

7.4.2.2 Measuring emotional well-being in the physical environment

Merging the qualitative and quantitative findings revealed some gaps in the results from certain measures, particularly the quantitative measures of sleep and emotional well-being which contributed few findings to the joint display tables (see Table 7.2 and Table 7.3). As mentioned in Section 6.5.1, it was challenging to collect data using questionnaires in this population, but this was not the only reason for the gaps in the merged data. The likely primary reason for the gaps is that the emotional well-being and sleep questionnaires that were used in this study were not inherently linked to the physical environment. They provided information regarding participants' mood, boredom, motivation, and sleep while they were in the rehabilitation environment, but they could not measure what aspects of the physical environment contributed to the participants' responses.

Alternatives to the emotional well-being questionnaires that were used would have been to develop a purpose-built questionnaire that asked participants how they felt in different spaces in the facility (e.g., bedroom, communal area, therapy area, etc.), or to ask participants to repeat the validated measures of state emotional well-being in each location to see whether their responses changed. These approaches would, however, have increased participant-burden and would not have addressed the limitations of conducting questionnaires in this population. Experience sampling methods were suggested in Section 6.5.2.3 as a possible alternative to the questionnaire measures of emotional well-being. Experience sampling methods would enable participants' responses to be directly linked to their location in the physical environment, and they would also provide a means of measuring participants' emotional well-being over the course of the day, or over the course of their recovery. These methods however, like questionnaires, rely on self-report and so may present problems in populations with language and communication impairments.

As mentioned briefly in Section 6.5.1.2, some environmental psychology research has utilised physiological measures such as heart rate or skin conductance to provide a proxy measure of emotional well-being in particular environments (Bower, Tucker, & Enticott, 2019). These proxy measures are well established for some aspects of mood, such as anxiety (Fowles, 1980), but are not well established in the measurement of other mental states, such as boredom, motivation, loneliness, or privacy. Some researchers have used mobile brain imaging technologies, such as mobile electroencephalogram (EEG), to measure global brain activity as participants move through a virtual or physical environment (Mavros, Austwick, & Smith, 2016). The feasibility of using mobile EEG with people with brain injury in a real or virtual a hospital setting is yet to be tested. There is, however, a study currently underway to

test the feasibility of using physiological measures (including heart rate and skin conductance) to measure stroke patients' responses to virtual hospital environments (Australian New Zealand Clinical Trials, anzctr.org.au, ACTRN12620000375954).

A significant challenge to measuring emotional well-being is in understanding what precise aspects of the overall construct are important to measure. Emotional well-being is an extremely broad, multi-dimensional construct and its definition differs widely from one discipline to the next. Even within one discipline, the different dimensions of emotional well-being are intimately intertwined – within rehabilitation, for example, the constructs of motivation, engagement, and attention are inter-related (see Section 1.2.2). The multi-dimensional nature of emotional well-being is likely to be one reason why qualitative methods proved more useful than quantitative methods for exploring emotional well-being in this study. Qualitative methods allowed the participants to reveal the aspects of emotional well-being that they felt were important, rather than these being presumed by the researcher at the outset. Indeed, some of the constructs that were central to the qualitative interview findings in this study – such as privacy and loneliness – were not considered in the quantitative measures. If the quantitative data had been collected after the qualitative data was analysed (i.e., sequential mixed methods instead of parallel), then quantitative measures of loneliness and privacy could have been incorporated. As it stands, future research could build on the results of this study by using existing measures of privacy and/or loneliness in healthcare to assess whether changes to the physical environment of rehabilitation facilities leads to any change in patients' responses (for examples of such measures see Hughes, Waite, Hawkey, & Cacioppo, 2004; Serenko & Fan, 2013).

7.4.2.3 *What is important to measure?*

One of the strengths of both mixed methods and multiple-case study research is the triangulation of results that can be achieved through the use of multiple sources of evidence and data collection (Yin, 2017). While there are benefits to the thoroughness of this approach, there are drawbacks to collecting large quantities of data. Some of these drawbacks can be addressed through good data management, which was facilitated in this study by software such as NVivo and REDCap (see Section 4.9). Other drawbacks include researcher time investment (which was addressed in Section 6.5.2), and participant burden. The possibility of participant burden is of particular concern in especially vulnerable and highly researched groups (Ulrich, Wallen, Feister, & Grady, 2005), such as hospitalised stroke patients. Researchers have an ethical responsibility to ensure that they have a sound reason for collecting all data and that they do not over-burden participants (National Health and Medical Research Council, 2007). Some of the measures that were used in this exploratory study yielded less helpful, or less important results, than others. For example, as outlined in the previous section, the self-reported questionnaires proved to be less helpful than the qualitative interviews. This study helped to reveal the more important patient variables (e.g., impairment type, activity, loneliness, privacy, etc.) and physical environment variables (e.g., variation, interest, patient-centredness, etc.) to consider in stroke rehabilitation, which will help future researchers to prioritise research questions and measures to streamline and optimise their data collection.

While the social environment is not the focus of this thesis (see Section 1.5), the qualitative findings outlined in Chapter 5 – especially Theme 3 – suggest important interactions between the physical and social environments at both cases. This interaction has been explored in previous research on healthcare settings

(Andrade, Lima, Devlin, & Hernández, 2016), and could be explored in future research in a stroke rehabilitation context by considering models of care and including measures of social support and interaction.

7.4.3 ***Multiple-case study methodology***

The embedded case study design provided a means of exploring variables relating to both the physical environment and the patient, and exploring relationships between these variables, in context, which was essential given the complexity of stroke rehabilitation environments and the likely interdependencies between the variables (see Sections 1.5 and 4.2).

The similarities and differences between the two cases aided in the interpretation of the qualitative and quantitative data in Chapters 5 and 6 respectively, and the replication of findings between the cases provided a measure of confidence to the development of the conceptual model in this chapter. The two cases were conducted almost concurrently (see Section 5.1). This was done for pragmatic reasons, to condense the data collection period, but it had the additional benefit of allowing immediate and continual comparison between the cases and ensuring that both cases were equally present in my mind during analyses.

Yin makes the distinction between statistical and analytical generalisability and states that, while the results of a case study cannot be statistically generalised to the wider population of cases, they can be used to make analytic generalisations and produce conceptual models or theories which can then be tested in other cases or larger samples (2017). The conceptual model developed in this study attests to the usefulness of the multiple-case study methodology in producing analytic generalisations.

Having said that, this study was first and foremost an exploratory study; a first attempt to identify and describe variables and relationships in context, in what is a very complex research area (see Figure 1.3, page 29). The results of this study – especially the quantitative results in Chapter 6 and the conceptual model in Section 7.3 – must be verified in future research before they can be confidently applied in practice or used to inform rehabilitation environments design.

7.5 Chapter summary

This chapter presented the merged results of a multiple-case study of two rehabilitation facilities in Victoria. The qualitative results consider patients' experiences of the physical environment of inpatient rehabilitation facilities, and the quantitative results report on the nature of their behaviour, emotional well-being, and safety in these spaces. A conceptual model was produced by merging the qualitative and quantitative results and interpreting them in the context of Person-Environment Fit theory. The resulting model proposes that stroke patients' behaviour, emotional well-being, and safety in rehabilitation will vary depending on the fit between a) patient competencies and b) the extent to which the physical environment can flexibly provide variation and interest, privacy without isolation, and a patient-centred design. Through developing this model, the concepts of privacy and patient-centred design were defined in the context of stroke rehabilitation. The next chapter (Chapter 8) will provide some final conclusions and a discussion of how this study (Study 3) and the other studies in this thesis (Studies 1 and 2) together contribute to the thesis aims and the field more broadly.

8 Discussion

8.1 Chapter overview

In this final chapter, the contributions from the three studies in this thesis are summarised in the context of the thesis aims (Section 8.2). The strengths and limitations of the exploratory approach that was used in this thesis are addressed in Section 8.3. Suggestions for future research directions are provided in Section 8.4, including some specific hypotheses that could be tested. Final conclusions are provided in Section 8.5.

8.2 Addressing the aims of this thesis

This thesis had two aims: to explore the role of the physical environment in inpatient stroke rehabilitation as it relates to patient recovery, and to explore different methods and measures for researching stroke rehabilitation environments (see Section 1.6).

8.2.1 ***Aim 1: Explore the role of the physical environment in inpatient stroke rehabilitation***

This primary aim was addressed via two subsidiary aims, which were to: 1) Describe how the physical environment of inpatient rehabilitation facilities supports, or could support, the process of learning and recovery post-stroke, i.e., identify the elements in the physical environment that are important for learning and recovery after stroke, and identify how these environments are, or could be, fit for the purpose of stroke rehabilitation; and 2) Explore the relationships between internal (patient) and external (physical environment) factors in post-stroke inpatient rehabilitation.

The first study in this thesis (Study 1, Chapter 2) laid the foundations for addressing the first of these subsidiary aims by describing the physical environment of the rehabilitation facilities in Victoria, Australia. This study also explored the question of what ‘purpose-built’ means in this context. Most rehabilitation facilities in Victoria were not originally built for the purpose of rehabilitation, and those that were built for rehabilitation may not be based on a rehabilitation-specific evidence-base and so may not be designed to support the process of learning and recovery post-stroke.

In the second study in this thesis (Study 2, Chapter 3), interdisciplinary experts were brought together to decide how the physical environment of a rehabilitation facility could best support learning and recovery after stroke. The main outcome was a new framework reflecting what is most important in the design of these spaces. According to this framework, in order for rehabilitation facilities to optimally support learning and recovery after stroke, the physical environment should: 1) maximise efficiency (minimise cost and time, and maximise the responsiveness of the space), 2) maximise efficacy (maximise patients’ outcomes by maximising their practice, activity, and sleep), 3) foster emotional well-being (for patients, staff, and visitors), and 4) maximise safety (for patients, staff, and visitors).

The third study in this thesis (Study 3, Chapters 4 to 7) addressed both subsidiary aims through a patient-focused, mixed methods study of two rehabilitation facilities in Victoria, Australia. The study explored patients’ experiences of the physical environment, and whether and how this environment (external factors) interacted with the patients’ competencies (internal factors) to support their behaviour, emotional well-being, and safety in the learning and recovery process after stroke. The study revealed four themes which describe patients’ experiences of the

physical environment: 1) entrapment and escape; 2) power, dependency, and identity in an institutional environment; 3) the rehabilitation facility is a shared space; and 4) the environment should be legible and patient-centred. These four themes were merged with the quantitative findings regarding patient behaviour, emotional well-being, and safety to produce three environmental principles which recommend how, from the patient perspective, the physical environment could be designed to be fit for purpose and best support learning and recovery after stroke. The three environmental principles are: 1) promote variety and interest in the environment, 2) allow for privacy without isolation, and 3) patient-centred design.

The findings from this study reconfirm the importance of considering the individual patient in stroke rehabilitation environments research. There was diversity in the competencies, behaviours, and emotional well-being of the stroke patients in this study. Their behaviour, emotional well-being, and safety in the rehabilitation environment appeared to vary depending on both internal (patient competencies) and external (environment) factors. The three environmental principles above describe the external factors that are important in this relationship. An individual patient's behaviour, emotional well-being, and safety will depend on the extent to which the variation and interest, privacy and isolation, and patient-centredness of the environment fits with this patient's competencies. To provide a fit for all patients, the physical environment must therefore, above all, be flexible.

8.2.2 *Aim 2: Explore methods and measures for researching rehabilitation environments*

As mentioned in the introduction to this thesis, it is unclear how best to research complex, people-environment relationships, especially in under-researched domains, such as stroke rehabilitation environments (see Section 1.1.3). The methods

and measures that were used in this thesis each had their strengths and limitations, and awareness of these may help to progress the field.

The descriptive survey method that was used in Study 1 (Chapter 2) provided structured data from a relatively large sample, and descriptions of some of the more macro features of rehabilitation buildings. Surveys are often used for descriptive studies and can provide a breadth of data using minimal resources, but they cannot provide detail or depth (Kelly, Clark, Brown, & Sitzia, 2003). The survey was not designed to address the people-environment relationship or the more complex aspects of rehabilitation environments, but it was a useful ‘first step’ in understanding and becoming familiar with these environments. If resources allow, future studies could consider conducting a descriptive survey via face-to-face site visits to ensure more complete data and this could be extended across Australia or more broadly.

The value-focused thinking expert elicitation method that was used in Study 2 (Chapter 3) did embrace the complexity of rehabilitation environments and proved to be an equitable and systematic way of sourcing and organising latent knowledge from many stakeholders. This method is novel in people-environments research. Its success in this study suggests that it could be similarly used to define priorities in other areas of healthcare design. Future studies could explore how to adapt the method so that more experts, and more areas of expertise, could be included. The workshops that were held in Study 2 also provided a platform to brainstorm which other methods and measures could be useful for researching rehabilitation environments, thereby directly addressing Aim 2 of this thesis (see Table 3.1, page 70).

The mixed methods multiple-case study methodology (Study 3, Chapters 4 to 7) provided a means to test a number of the methods and measures that were suggested in the Study 2 workshops. The mixed methods multiple-case study

methodology itself was challenging to execute because of the many strands of enquiry, the large amounts of data that were produced, and the skills required in both qualitative and quantitative research to undertake, collate, and analyse these data. The methodology did, however, allow me to immerse myself in the topic and to explore relationships without isolating any of the interconnected and interacting agents that comprise rehabilitation environments. It was therefore useful for researching a complex, previously under-researched topic.

Although the overall methodology was useful, some of the methods and measures that were used to collect data within this methodology were more useful than others. The walk-through semi-structured interview format was a successful means of qualitatively linking human experience to the physical environment and could be used in future people-environment studies, as it has been done in the past (see Section 5.5.4.3). Adaptation of these interviews to facilitate inclusion of people with cognitive and language difficulties worked to a degree and further development of this approach should be encouraged in future research (see Section 5.5.4.3). Some of the quantitative measures that were used (specifically the healthcare design checklists and the emotional well-being and sleep questionnaires) highlighted the need for validated, rehabilitation-specific measures that address the link between people and the physical environment, and that are appropriate for populations with language and/or cognitive impairments.

There is an exciting future ahead in technological solutions to quantitatively measure people-environment interaction. Some of these methods and measurement tools were discussed in Chapter 6 (Section 6.5.2) and Chapter 7 (Section 7.4.2.2).

8.2.3 ***Additional contributions of this thesis***

One benefit of exploratory research is that unexpected avenues can be investigated as they emerge (for more discussion of the benefits and limitations of exploratory research, see Section 8.3 below). This thesis has made a number of additional contributions to the field, besides those that met the pre-specified aims outlined above. From the outset, an applied and interdisciplinary approach was taken in this thesis; practitioners in healthcare and design and service users (patients and staff) were invited to take part and have been kept informed of findings throughout (see Preface section on page v, Publications and presentations section on page ix, and Section 1.5). One of the intentions of using this approach was to raise awareness of the importance of designing and providing environments that are fit for the purpose of stroke rehabilitation – to start and maintain a conversation with the people who are best placed to influence change. This is an ongoing process of research translation, and one that will continue beyond this thesis (see Section 8.4 below).

More specifically, this thesis has introduced the concept of rehabilitation environments as both a learning and a healthcare environment, which has the potential to re-frame how practitioners consider and design these spaces. The three environmental principles that were defined in Study 3 (Chapter 7) provide some direction for designers hoping to create rehabilitation spaces that are suited for both learning and healthcare. Through defining these principles, definitions were also developed for some underlying, but critical, concepts in stroke rehabilitation that had not previously been well defined: patient privacy without isolation and patient-centred design. All aspects of stroke rehabilitation research and practice, beyond those specific to the physical environment, stand to benefit from a better understanding of these concepts.

8.3 Strengths and limitations of the overall research approach

In this thesis, the physical environment of inpatient rehabilitation facilities was viewed as part of the complex, situated stroke rehabilitation system; a system which should be studied as a whole (see Section 1.5). This view, combined with the scarcity of prior research and the underlying paradigm of pragmatism, informed the exploratory approach that was used in this thesis, which in turn informed the type of studies that were conducted and therefore the nature of the findings that are reported. The benefits and limitations of having taken this situated, exploratory approach are explored in this section.

8.3.1 *Ecological validity and control*

There has long been a tension in People-Environment studies between ecological validity and the control that the researcher has over the variables being studied (Devlin, 2018). Ecological validity refers to the extent to which the research setting reflects the real-world setting that is under investigation. Generally, ecological validity comes at the cost of control in research, and vice versa. The research in this thesis was situated in the real world. The real world is central to pragmatism (the problem must be real), but there is no claim that this real world can be defined by one ultimate truth (see Section 1.5). In this sense, the pragmatists' worldview has similarities to the practical but creative approach used by designers. Results of a pragmatic inquiry such as that in this thesis may therefore lend themselves to easy interpretation and implementation by designers (Moore & Geboy, 2010). The downside of this approach is that the variables in the setting cannot be controlled and

so the findings in this thesis cannot deliver cause or effect statements about exactly which design features might impact patients' outcomes, how much, and in what way.

Research that is conducted in a laboratory, on the other hand, has low ecological validity, but the researcher can control or eliminate all extraneous variables, thereby making it easier to determine in what way the variables of interest impact each other. Future researchers could draw on the findings from this exploratory study to develop targeted hypotheses about people-environment relationships which could be tested in a more controlled setting. Potential hypotheses and some suggestions for the form that these more controlled research studies could take are outlined in Section 8.4 below.

8.3.2 *The importance of engaging service users in research and design*

The pragmatic worldview acknowledges that there are many different types of knowledge (see Section 1.5). One of the strengths of this thesis lies in the emphasis that has been placed on the service users' perspective. Staff and/or patients participated in all three studies, patients with language and/or cognition impairments were supported to participate, and a consumer advisor was involved in the research design, piloting of methods and measures, and analysis in Study 3. There were challenges associated with patient participation, including missing data and the potential for participant burden (see Sections 6.5.1.2 and 7.4.2.3). These could be avoided in future studies through more extensive piloting of all methods and measures with patients of various competencies prior to data collection.

There are examples throughout this thesis of service users' expertise and the essential contributions that they can provide to research. Many of the staff who were surveyed in Study 1 knew a significant amount about the history of their building and had opinions about its functionality (see Section 2.3). Staff and patients provided

essential contributions to the expert elicitation workshops in Study 2 (see Section 3.3). The healthcare design checklists used in Study 3 were impossible to complete without input from staff who had local knowledge of the building (see Section 5.5.4.1). The interviews conducted in study 3 revealed that patients do notice when the environment does and does not support the system of care, and they can articulate this if they are supported to do so (see Section 5.4). Clearly, staff and patients are capable of contributing to evidence-based healthcare design and architects and planners should endeavour to routinely take advantage of this wealth of expertise in a meaningful way throughout the design process, including in the very early stages of planning. This will be discussed further in Section 8.4.4 below.

8.4 Future directions

As an exploratory study, this thesis is only the first step in the scientific process to understand the role of the physical environment in stroke rehabilitation and, ultimately, inform the design of purpose-built rehabilitation facilities (see Figure 1.3, page 29). This section outlines some of the steps that could be taken to progress research and practice in this field.

8.4.1 *Expanding the conceptual model to all service users*

Study 2 of this thesis considered the needs of all service users – including staff, patients, visitors, health administrators and planners – to develop a framework of everything that is fundamentally important for the rehabilitation process after stroke (see Section 3.3). Study 3, however, focused only on the patient-specific objectives from this framework (see Figure 4.2, page 76), without directly addressing the staff, visitor, and operational efficiency needs (see the remaining fundamental

objectives in Figure 4.1, page 75). While it is important to consider the patient, the framework that was developed in Study 2 does specify that the emotional well-being of staff and visitors and the efficiency of care are also fundamentally important if a rehabilitation environment is to support learning and recovery post-stroke (see Figure 3.1, page Figure 3.1). Future studies should address these remaining fundamental objectives. Some potential research methods could include interviewing staff and visitors, mapping staff and visitor activities, performing a clinical operation audit, and/or health economics analysis (see further suggestions in Table 3.1, page 70). It is especially important to establish the economic argument for optimising the rehabilitation environment in order to increase the likelihood of investment and implementation. The results of these future studies could be used to expand the conceptual model that was developed in Study 3 so that it describes the role of the physical environment in stroke rehabilitation more broadly – not only in relation to patient behaviour, emotional well-being, and safety.

This thesis focused on the role of the physical environment in stroke rehabilitation, but none of the findings will be effective in practice if they are not accompanied by equivalent changes in the social environment, namely the clinical policies, of rehabilitation. If there is to be a change towards more variety and interest, privacy without isolation, and patient-centred design in the physical environment of rehabilitation facilities, then clinical practice will need to reflect this by instituting policies that put patients' needs and rights at the forefront. Without these changes, patients may continue to feel that they do not have the permission or the right to access the services and structures that are provided in the environment. The social environment of rehabilitation facilities is therefore an area worthy of future research.

In addition, this thesis is focused on the Australian context. The conceptual model developed in this thesis could be expanded and tested in future research in other countries to provide a more global perspective.

8.4.2 ***Hypothesis testing: Balancing ecological validity and control***

As mentioned in Section 8.3.1, researchers can use the findings from this thesis to develop hypotheses which could be systematically addressed using controlled research methods. Each of the connections in the framework in Study 2 represents a hypothesis which could be tested. For example, one of the hypotheses implied by the connections radiating from the means objective to ‘maximise outdoor and green space’ could be: Patients in inpatient stroke rehabilitation facilities with more outdoor and green space will participate in more physical and cognitive practice and have better emotional well-being than patients in facilities with less outdoor and green space (see Figure 3.1, page 68). This example hypothesis is supported by evidence regarding the importance of green spaces in healthcare settings (Cooper Marcus, 2018). The other potential hypotheses identified in Study 2 may vary in the extent of their existing evidence-base, but each of these hypotheses are nonetheless worthy of further investigation by virtue of them having been identified as important by the experts in this study.

As mentioned in Section 7.4.1, the conceptual model developed in Study 3 could itself be tested to see whether patients’ outcomes improve if the three environmental principles (variety and interest, privacy without isolation, and patient-centred design) are realised in the physical environment. Targeted investigations could be carried out to determine the role of particular design features in stroke rehabilitation, or the role of individual patient differences. Hypothesis testing calls for a more controlled research design, so that the variables of interest can be isolated (see

Section 8.3.1). Some potential research methodologies are outlined in this section, including natural experiments, simulations, and large-sample data linkage studies.

8.4.2.1 *Natural experiments and post-occupancy evaluations*

Research opportunities arise whenever a rehabilitation facility moves from an old building to a new building, or when an existing facility is refurbished. Such events are relatively rare, but they have the potential to provide natural experiments where hypotheses can be tested in an ecologically valid setting. For example, a new rehabilitation facility could be designed to incorporate the graded communal spaces that respond to the conceptual model developed in Study 3 (see Figure 7.3, page 286), and patient behaviour, emotional well-being, and safety could then be compared between the old and the new facility to determine the impact of this design innovation. Critically, three conditions need to be considered if these natural experiments are to be valid and informative: 1) the patient profile and clinical model must remain unchanged in the move from the old to the new facility so that any changes to patient outcome can be more confidently attributed to the physical environment; 2) the physical environment of the new facility must be markedly different from that of the old facility – if the new facility is designed according to the same evidence or the same best practice as the old facility, then any changes in patient outcome cannot be attributed to the physical environment; and 3) the findings must be disseminated and made freely available. These three conditions are addressed in turn below.

Regarding the first condition, in practice, the clinical model rarely remains unchanged when a facility moves to a new building (Pati, 2010). Healthcare administrators understandably take advantage of the upheaval of a move to update clinical processes. In addition, as outlined throughout this thesis, physical and social

environments are inextricably linked, so clinical processes are likely to change in a new physical setting even if these changes are not pre-planned. These natural experiments cannot, therefore, be used to provide cause and effect statements about the physical environment (Pati & Pati, 2013). That is not to say that new builds and refurbishments should not be utilised by researchers, but it is important to acknowledge that they may be much less controlled than they first appear, and this should be taken into consideration in the research design, analysis, and interpretation of results.

Regarding the second condition raised above, there has unfortunately been very little innovation in rehabilitation facility design (see results of Study 1, Chapter 2, and also Sections 3.2 and 5.2.3) and this suggests that new rehabilitation facilities are rarely markedly different from old facilities, besides having a more modern and well-maintained aesthetic. This lack of innovation may be due in part to the cycle of post-occupancy evaluations and the incremental changes that this engenders. The stated aim of post-occupancy evaluations is to identify what has been done well and what could be done differently in subsequent designs in order to better address the requirements of the service users (Federal Facilities Council, 2001). They therefore represent a problem-solving, or problem-driven, approach to design, where shortfalls and positives are identified after completing a new building in order to inform subsequent designs.

An alternative to problem-driven design is possibility-driven design, where the focus is on striving to create new possibilities for optimising the well-being of the users (Desmet & Hassenzahl, 2012). In other words, designers using a problem-driven approach will strive to avoid harm, while designers using a possibility-driven approach will strive to do good (Desmet & Pohlmeier, 2013). There is a difference,

for example, between 1) the problem-driven approach of designing a rehabilitation facility with the aim to reduce patient inactivity and depression, and 2) the possibility-driven approach of designing a rehabilitation facility with the aim to promote patient activity, participation, and optimal emotional well-being. The former may make the situation better, but only the latter can go “beyond neutrality” to make the situation optimal, the best it could be (Desmet & Pohlmeier, 2013, p. 11).

Possibility-driven design is more amenable to innovative change because, like the Value-Focused Thinking process utilised in Study 2 (see Section 3.3), it focuses on what is most valued in the ultimate end-goal, rather than on evaluating the existing alternatives. Post-occupancy evaluations are essential to building evidence-based healthcare design (provided their findings are disseminated – see below), but their problem-driven approach to design may play a part in slowing innovation. This could be countered by adding possibility-driven approaches to healthcare environments design and research, especially in the early stages of designing a new building. A model for this is proposed in Section 8.4.5 below.

Apart from the focus on problem-driven design, the lack of innovation in rehabilitation environments thus far can perhaps also be attributed to the previous scarcity of rehabilitation-specific research available to inform these designs. Relevant research is, however, now emerging (e.g., the studies listed at the start of Section 1.4 and the research in this thesis). If this new research is not integrated into practice, then prevailing evidence relating to general healthcare facility design will continue to be used to inform rehabilitation environments. It is critical for healthcare planners and design practitioners to continue to question this prevailing evidence as it relates to rehabilitation, and to be kept informed of new, rehabilitation-specific evidence to

ensure that opportunities for design and innovation in this unique setting are not missed – which relates to the third consideration raised above.

Leaders in evidence-based healthcare design have long called for more transparent and freely available pre- and post-occupancy evaluations so that each new building can contribute to the evidence-base and help to improve future hospital design (Hamilton, 2009; Preiser, 2003; Shepley, 1997). These evaluations are occasionally made available through research publications, but the majority of organisations choose to keep their evaluations internal (Zimring & Rosenheck, 2001). In Australia, many new hospitals are financed by Public Private Partnerships (PPPs) – for example Case 2 in Study 3, see Section 5.2.1 – which may be part of the reason why the post-occupancy evaluations of public hospitals are rarely retained in the public record. There have been efforts in Australia to standardise post-occupancy evaluations and ensure that they are made widely available (Carthey, 2006), but these efforts have not yet resulted in systemic change. More integration is needed between research, policy, and practice in order to ensure that evaluations of rehabilitation facilities are consistently made available to inform future design (Li, Froese, & Brager, 2018).

There have been movements internationally to establish an ongoing collaboration between practice and research in evidence-based healthcare design. The Pebble Project in the USA, for example, is a joint effort between researchers and healthcare providers to ensure that new healthcare buildings are based on evidence, and that they feed evidence back into research (Joseph & Hamilton, 2008). Healthcare providers can choose to become a member of the project, pledging to use and produce evidence-based design research in all their future building projects, and in turn they get access to the evaluation tools and methodologies provided by researchers. A

model such as the Pebble Project would facilitate collaboration between research and practice in rehabilitation facility design and so ensures that each new building and refurbishment is also a research opportunity, thereby informing and improving future rehabilitation environments.

8.4.2.2 *Simulations*

An alternative, more controlled, approach to testing hypotheses about the physical environment would be to expose participants to simulated environments and measured how the participants' responses change as changes are made to the environment. Some previous studies have used real simulations (such as ward mock-ups) and some have used virtual simulations (such as those mentioned in Section 7.4.2.2) (Idi & Khaidzir, 2018). Technologies for virtual and augmented reality are constantly improving and, after the initial purchase costs, they allow for rapid prototyping and testing of different environments (Choi & Chan, 2004). A single design variable can be changed in the virtual environment, and a number of different variations of that variable tested while holding all other variables constant, thereby allowing the researcher to understand in what way specific design variables are impacting the participant.

There is some evidence that virtual environments evoke a similar behavioural and neurological response as that evoked by matched real environments (Kuliga, Thrash, Dalton, & Hölscher, 2015), and this is likely to be further established as the technologies improve. Still, virtual and real simulations are obviously limited in their ecological validity. They cannot (at least, not yet) provide all the complexities of a real environment, particularly when it comes to the interconnections between the social and physical environment. Participants cannot spend extended periods of time in these environments (certainly not equivalent to the 5.5 weeks that stroke patients

average in inpatient rehabilitation, see Section 1.1.2), and the feasibility of exposing stroke patients to these simulations has not yet been established. There is, however, research currently being conducted to test the feasibility of using virtual reality with past stroke patients (see Section 7.4.2.2).

8.4.2.3 *Checklists to facilitate data linkage*

As outlined in Section 7.4.1, a targeted checklist, assessment tool, or validated measure of the rehabilitation environment would help to advance rehabilitation environments research. In Australia, the Stroke Foundation conducts a regular audit of the services provided by rehabilitation facilities (Stroke Foundation, 2018). The scope of this audit could potentially be extended in the future to include standardised questions regarding the physical environment of the rehabilitation facilities, perhaps building on the questions that were included in the survey in Study 1 of this thesis (see Section 2.3), and the findings of Studies 2 and 3.

Stroke patients' rehabilitation outcomes are routinely collected in Australia by the Australasian Rehabilitation Outcomes Centre (AROC) (Australasian Rehabilitation Outcomes Centre (AROC), 2018). If the physical environment of each rehabilitation facility were to be assessed in the Stroke Foundation audit, then these results could be linked to the clinical outcomes data from AROC to assess whether patient outcomes varied with facilities' scores on the physical environment section of the audit. A data linkage study of this kind would produce a large sample thereby allowing researchers to investigate whether particular aspects of the physical environment (as measured by questions in the audit) predict patient outcomes. The quality of such research would depend largely on the quality of the questions concerning the physical environment that are added to the audit. It is critical that these questions capture the extent to which the physical environment is fit for the purpose

of rehabilitation. Development of an evidence-based checklist, assessment tool, or set of standardised questions should therefore be a priority for future rehabilitation environments research.

8.4.3 ***Planning for the future of rehabilitation***

As mentioned in Section 1.1.2, the number of people requiring rehabilitation is likely to increase as stroke incidence escalates, acute treatments improve and more people survive a stroke (Stroke Foundation, 2017). These changes may result in a change in the clinical and demographic profile of stroke patients. In addition, there is evidence that early supported discharge – where patients are supported to leave hospital early and receive rehabilitation at home or as an outpatient – may reduce long-term dependency in some stroke patients (Langhorne, Baylan, & Early Supported Discharge Trialists, 2017). This clinical model is common in the United Kingdom and is likely to become more widespread worldwide in the coming years. Some research is planned to investigate the importance of the home environment in home-based rehabilitation (Kylén et al., 2019).

Telehealth is also becoming more viable in physical and cognitive stroke rehabilitation (Johansson & Wild, 2011; Rubin, Wellik, Channer, & Demaerschalk, 2013), as it is in all areas of healthcare. The need for telerehabilitation for stroke has become increasingly apparent during the current COVID-19 pandemic (see Stroke Foundation [informme.org.au](https://www.informme.org.au)). It is likely that these services will continue beyond the pandemic and provide a new suite of care approaches. Rehabilitation environments will need to be adaptable in order to accommodate the changing patient profile and clinical model of rehabilitation (adaptability was defined in Section 3.3) and these considerations will need to be taken into account in future rehabilitation environments research and facility design.

Considering the ongoing change and progress in rehabilitation services, it would perhaps be unwise for rehabilitation environments researchers to strive to find the ultimate, or perfect rehabilitation facility design. A design that is considered adaptable by today's standards will likely be bettered in subsequent years. Researchers and practitioners should remain responsive and ensure that each new design reflects the contemporary needs of the service. Instead of aiming to produce one ultimate design, researchers could instead aim to produce a design process – one which encourages collaboration between researchers, government, and industry, and which continually responds to the changing needs of rehabilitation. A possible model will be outlined in Section 8.4.5 below.

8.4.4 ***Incorporating interdisciplinary and co-design methodologies***

This thesis has emphasised stroke rehabilitation as a complex system involving interactions between the patient, the social environment, and the physical environment (see Figure 1.1, page 12). In reality, every aspect of this system is influenced by the wider governmental and policy context, and in some countries, the commercial context of private healthcare and industry. Any attempt to translate or implement the findings in this thesis, or any future rehabilitation environments research, would require input from stakeholders in industry, policy, and government. Rehabilitation-environments, and indeed all healthcare-environments design, is an interdisciplinary exercise. The interdisciplinary approach used in Study 2 of this thesis highlighted the challenges and benefits of engaging multiple stakeholders in a meaningful (as opposed to token) way (see Section 3.3). Many design practitioners are accustomed to working with multiple stakeholders, and are well-versed in using visualisation tools (drawings and mock-ups) to promote interdisciplinary discussion and cooperation (Kasali & Nersessian, 2015). Researchers and design practitioners

can play an important role in establishing and maintaining networks between stakeholders (see Section 8.4.2.1 above), but ultimately, every new design will need to be financed and endorsed by policy makers and healthcare providers, so any successful cycle between research and practice in rehabilitation environments must be led by these sectors.

The findings from Study 3 emphasise the environmental principle of patient-centred design in stroke rehabilitation environments (see Section 7.3). If this environmental principle is to be realised in practice, it will be essential to involve patients throughout the design process so that they can define how the environment can support their needs and how it can best be coherent and convenient for them (Elf, Fröst, Lindahl, & Wijk, 2015; Shepley, Pasha, & Ferguson, 2013). The question is not *whether* service users should be included in evidence-based healthcare design and research, but *in what way* they should be included and *how* their input can best be sought. There are many frameworks available to guide the involvement of patients and other service users in research (Greenhalgh et al., 2019). Consumer involvement is now expected, and often required, in most healthcare research (National Health and Medical Research Council, 2016). Alongside these developments in healthcare research, co-design methodologies have been welcomed in many design disciplines (Sanders & Stappers, 2008), including the design of healthcare services and technologies (Bate & Robert, 2006). However, apart from some notable exceptions – including the Design for Health and Wellbeing (DHW) Lab in New Zealand (Reay et al., 2017) and the ‘Cardboard hospital’ in Norway (Kronqvist, Erving, & Leinonen, 2013) – there have been very few realised efforts to co-design healthcare environments.

It is usually required for hospital architects to consult with hospital staff during design, but these consultations are not equivalent to a true co-design process and patients are often not included (Elf et al., 2015). Many hospital staff who are involved in healthcare design consultation feel unprepared and poorly informed about the project, and, compared to the architects and planners, the staff do not feel that the consultation process achieves the desired results (Carthey, 2020a). Architects report that they find it challenging to involve end-users (Groeneveld, Dekkers, Boon, & D'Olive, 2018). Consultation could be more effective if efforts were made to establish a shared language, common goals, and collaborative decision-making (Carthey, 2020b), which could be facilitated by many of the participatory design or co-design approaches that are used in other fields (Sanders & Stappers, 2008). Involving stroke patients in design would present additional challenges, many of which would be similar to the challenges of involving stroke patients in research, but co-design is a necessary approach to consider if true patient-centred design is the goal, and the challenges of including patients in this process can be overcome given enough resources, planning, and piloting.

8.4.5 *A new way forward for designing rehabilitation facilities*

The sections above highlight a number of critical factors which must be considered in order to progress rehabilitation environments research and practice: 1) the importance of both ecological validity and control; 2) the need for design innovations rather than incremental changes; 3) the ever-changing nature of rehabilitation cohorts and services; 4) the value of early and meaningful collaboration with service users; and 5) the need for an interdisciplinary network led by policy and healthcare providers.

Figure 8.1 shows a proposed model which addresses each of these critical factors. In this model, every rehabilitation building or refurbishment is used as an opportunity to respond to overarching environmental principles from research, implement design innovations in context, and measure their impact (top of the large circle in Figure 8.1). To achieve this model, a strong collaboration would first need to be established between research, policy, and rehabilitation providers – similar to the collaborations that underpin the Pebble Project (see Section 8.4.2.1 above). In addition, this collaboration would need to extend to researchers, design practitioners, and industry partners specialised in co-design and real and virtual simulations. These partners would facilitate the more controlled arm of the cycle (bottom left of Figure 8.1) to test and refine each new design choice, continue to progress the evidence-base, and then feed into the design for each new building and refurbishment.

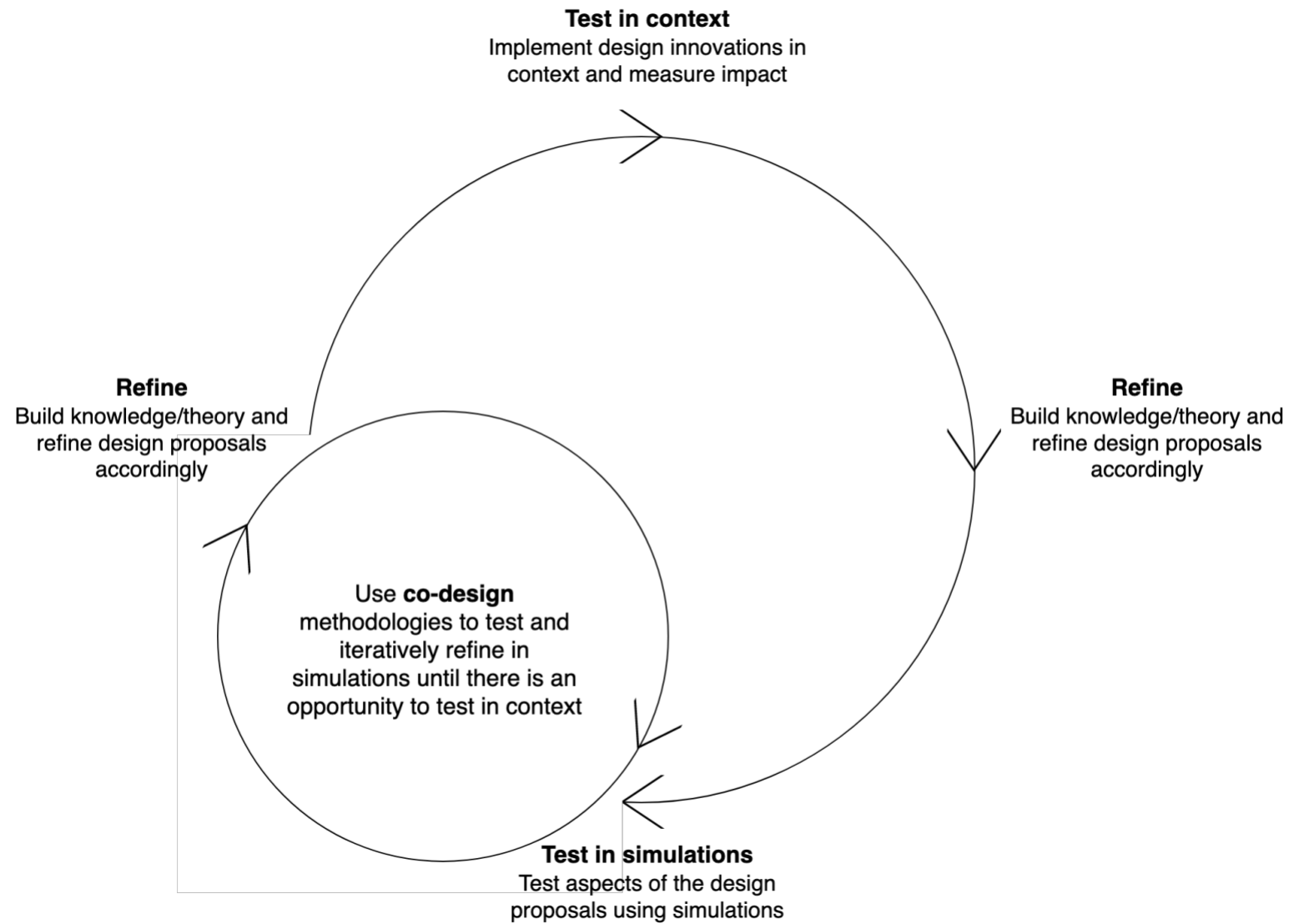


Figure 8.1 A new model for rehabilitation environments research and design.

A rehabilitation-specific toolkit would need to be developed to measure the success of each new building and refurbishment. This toolkit could incorporate a rehabilitation-specific audit tool to assess the extent to which the physical environment is fit for purpose (see Section 8.4.2.3 above), and also a suite of tools to measure the outcomes that are important in rehabilitation. These tools might include measures of patient activity, sleep, and falls, of staff and patient emotional well-being, and measures of the other outcomes that are found in future research to be important for efficiency, efficacy, emotional well-being, and safety in stroke rehabilitation. Some of the measures and methods that were used in this thesis could be incorporated into this toolkit (e.g., behavioural mapping and walk-through semi-structured interviews). Importantly, the findings from this thesis suggest that it would be beneficial for such a toolkit to include both qualitative and quantitative methods and measures. Indeed, researchers who have developed evaluation toolkits for other complex and specialised healthcare settings, such as mental health, recommend a mixed methods approach (Ahern, McKinnon, Bieling, McNeely, & Langstaff, 2016). Since this rehabilitation environments evaluation toolkit would be part of an ongoing cycle of research, the outcomes that are measured could be revised and updated as the rehabilitation service, design, and associated evidence-base evolve.

In addition to addressing the five critical factors outlined above, this proposed model of rehabilitation environments research and design has the potential to offer a number of other benefits for the sector. The model is, for example, economically prudent because each new rehabilitation building and refurbishment can provide both a capital infrastructure investment and a research opportunity. In addition, the cyclical nature of the model can provide benefits at both a macro and micro level – macro benefits to the rehabilitation sector as a whole, our understanding of rehabilitation

environments, and person-environment interaction more broadly; and benefits at the micro level for each rehabilitation service that receives an evidence-based new building or refurbishment.

8.5 Conclusions

To be fit for the purpose of stroke rehabilitation, the physical environment of inpatient rehabilitation facilities ought to promote and optimise patients' physical, mental, and social well-being for maximum recovery and learning after stroke. Inpatient rehabilitation facilities are rarely purpose-built, and there is very little evidence to inform their design. Patients of all competencies experience a sense of entrapment, loneliness, and powerlessness in the environment in rehabilitation which may negatively impact their learning and recovery. To change this, the environment must provide variety and interest, privacy without isolation, and patient-centred design to the extent required by each patient's competencies. With these principles in place, future rehabilitation facilities can be designed to be more than just a physical space in which the practicalities of rehabilitation occur. They can be emotionally supportive spaces and spaces for learning: a place that provides both the physical and psychological space for recovery.

The findings in this thesis provide detailed considerations of ecologically valid rehabilitation environments, indications as to which aspects of the physical environment might be most important, and insights into methodologies – all of which could contribute to innovative design and future research. To advance the field, it will be critical to develop strong collaborations with health policy makers and rehabilitation service providers. Healthcare buildings are expensive, but good health, like good design, is not just a question of money: it is a question of choice and

priorities, and a question of human rights. Stroke rehabilitation patients – indeed, all patients – have a right to dignity and privacy, and a right to be in a space that promotes their health and recovery. It is clear that the physical environment of rehabilitation facilities may be detrimental, or at best, not beneficial, for patients during the vulnerable time of recovery and learning after stroke. There is therefore an ethical imperative to advance the field and ensure that rehabilitation facilities are designed to promote good health and well-being for stroke patients.

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Appendices

Appendix 1: Co-author authorisation forms



Co-author authorisation form

All co-authors must complete this form. By signing below co-authors agree to the listed publication being included in the student's thesis and that the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

In cases where all members of a large consortium are listed as authors of a publication, only those that actively collaborated with the student on material contained within the thesis should complete this form. This form is to be used in conjunction with the *Declaration for a thesis with publication form*.

Students must submit this form, along with the *Declaration for thesis with publication form*, when the thesis is submitted to the Thesis Examination System: <https://tes.app.unimelb.edu.au/>

Further information on this policy and the requirements is available at:
gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication

A. PUBLICATION DETAILS (to be completed by the student)		
Full title	A Framework for Designing Inpatient Stroke Rehabilitation Facilities: A New Approach Using Interdisciplinary Value-Focused Thinking	
Authors	Ruby Lipson-Smith, Leonid Churilov, Clare Newton, Heidi Zeeman, and Julie Bernhardt	
Student's contribution (%)	70	
Journal or book name	Health Environments Research & Design Journal (HERD)	
Volume/page numbers	12(4), 142-158	
Status	☐ Accepted and In-press ☒ Published ☐ In progress	Date accepted/published 25/02/2019

B. CO-AUTHOR'S DECLARATION (to be completed by the collaborator)		
I authorise the inclusion of this publication in the student's thesis and certify that:		
- the declaration made by the student on the <i>Declaration for a thesis with publication form</i> correctly reflects the extent of the student's contribution to this work; - the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.		
Co-author's name	Co-author's signature	Date (dd/mm/yy)
Leonid Churilov	<i>Leonid Churilov</i>	03/02/20

Co-author authorisation form

All co-authors must complete this form. By signing below co-authors agree to the listed publication being included in the student's thesis and that the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

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Full title	A Framework for Designing Inpatient Stroke Rehabilitation Facilities: A New Approach Using Interdisciplinary Value-Focused Thinking		
Authors	Ruby Lipson-Smith, Leonid Churilov, Clare Newton, Heidi Zeeman, and Julie Bernhardt		
Student's contribution (%)	75		
Journal or book name	Health Environments Research & Design Journal (HERD)		
Volume/page numbers	12(4), 142-158		
Status	☐ Accepted and In-press ☐ In progress	☒ Published	Date accepted/published 25/02/2019

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Co-author's name	Co-author's signature	Date (dd/mm/yy)
Clare Newton		30/01/20

Co-author authorisation form

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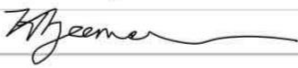
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Full title	A Framework for Designing Inpatient Stroke Rehabilitation Facilities: A New Approach Using Interdisciplinary Value-Focused Thinking		
Authors	Ruby Lipson-Smith, Leonid Churilov, Clare Newton, Heidi Zeeman, and Julie Bernhardt		
Student's contribution (%)	75		
Journal or book name	Health Environments Research & Design Journal (HERD)		
Volume/page numbers	12(4), 142-158		
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Co-author's name	Co-author's signature	Date (dd/mm/yy)
Heidi Zeeman		01/05/20

Co-author authorisation form

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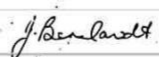
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Co-author's name	Co-author's signature	Date (dd/mm/yy)
Julie Bernhardt		01/05/20

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gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication

A. PUBLICATION DETAILS (to be completed by the student)

Full title	What's in a Building? A Descriptive Survey of Adult Inpatient Rehabilitation Facility Buildings in Victoria, Australia		
Authors	Ruby Lipson-Smith, Heidi Zeeman, and Julie Bernhardt		
Student's contribution (%)	75		
Journal or book name	Archives of Rehabilitation Research and Clinical Translation		
Volume/page numbers	2(1), 1-9		
Status	☐ Accepted and In-progress ☒ Published ☐ In progress	Date accepted/published March 2020	

B. CO-AUTHOR'S DECLARATION (to be completed by the collaborator)

I authorise the inclusion of this publication in the student's thesis and certify that:

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Co-author's name	Co-author's signature	Date (dd/mm/yy)
Heidi Zeeman		01/05/20

Co-author authorisation form

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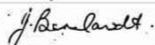
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Authors	Ruby Lipson-Smith, Heidi Zeeman, and Julie Bernhardt		
Student's contribution (%)	75		
Journal or book name	Archives of Rehabilitation Research and Clinical Translation		
Volume/page numbers	2(1), 1-9		
Status	☐ Accepted and In-press ☒ Published ☐ In progress	Date accepted/published March 2020	

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Co-author's name	Co-author's signature	Date (dd/mm/yy)
Julie Bernhardt		01/05/20

Appendix 2: Ethics approval for Study 1

25 May 2017



Dear Julie, Heidi and Ruby,

I am pleased to advise that the Architecture, Building and Planning Human Ethics Advisory Group has approved the following Minimal Risk Project.

Project Title: Describing the design of inpatient rehabilitation facilities in Victoria
Researchers: Prof H Zeeman, Professor J Bernhardt, R Lipson-Smith
Ethics ID: 1749537

The project has been approved for the period: 25 May to 31 December 2017.

It is your responsibility to ensure that all people associated with the project are made aware of what has been approved.

Research projects are normally approved to 31 December of the year of approval. Projects may be renewed yearly for up to a total of five years upon receipt of a satisfactory annual report. If a project is to continue beyond five years, a new application will normally need to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

(a) Limit of approval: Approval is limited strictly to the research as submitted in your project application.

(b) Amendments to project: Any subsequent variations or modifications you might wish to make to the project must be notified formally to the Human Ethics Advisory Group for further consideration and approval before the revised project can commence. If the Human Ethics Advisory Group considers that the proposed amendments are significant, you may be required to submit a new application for approval of the revised project.

(c) Incidents or adverse effects: Researchers must report immediately to the Advisory Group and the relevant Sub-Committee anything which might affect the ethical acceptance of the protocol including adverse effects on participants or unforeseen events that might affect continued ethical acceptability of the project. Failure to do so may result in suspension or cancellation of approval.

(d) Monitoring: All projects are subject to monitoring at any time by the Human Research Ethics Committee.

(e) Annual Report: Please be aware that the Human Research Ethics Committee requires that researchers submit an annual report on each of their projects at the end of the year, or at the conclusion of a project if it continues for less than this time. Failure to submit an annual report will mean that ethics approval will lapse.

(f) Auditing: All projects may be subject to audit by members of the Sub-Committee.

Please quote the ethics registration number and the name of the project in any future correspondence.

On behalf of the ethics Committee, I wish you well in your research.

Yours sincerely,

Dr David O'Brien - Chair
Architecture, Building and Planning Human Ethics Advisory Group

Ceira Barr | Graduate Research and Ethics Officer
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Appendix 3: Supplementary material for Study 1 manuscript

Three supplementary materials were published with Lipson-Smith, et al. (2020):

- 1) The deidentified individual facilities data (supplemental appendix S1) which can be downloaded [here](#).
- 2) Publicly available photographs of the included facilities (supplemental appendix S2) which is included on following page.
- 3) An infographic summary of the results (supplemental appendix S3) – see below.

Name	Photograph	Source (website)
Albury Wodonga Health (Wodonga Campus)		https://www.hospitalstays.com.au/hospitals/albury-wodonga-health-albury-campus/20
Angliss Hospital - Eastern Health Inpatient Access Unit		https://www.hospitalstays.com.au/hospitals/angliss-hospital/468
Bairnsdale Hospital		http://www.brhs.com.au/about/campuses/
Ballarat Health Services (Queen Elizabeth Centre)		https://www.bhs.org.au/
Barwon Health - McKellar Centre Campus		https://www.barwonhealth.org.au/patients-visitors/column-2/mckellar-centre
Bass Coast Health/Wonthaggi Hospital		https://www.hospitalstays.com.au/hospitals/bass-coast-regional-health/378
Bendigo Health Care Group		http://bendigohospitalproject.org.au/gallery/#1455499909165-2e072256-0c31
Broadmeadows Health Service		https://www.hospitalstays.com.au/hospitals/broadmeadows-health-service/475
Bundoora Extended Care Centre		https://www.viaarchitects.com.au/projects/health-architects/bundoora-extended-care-centre/
Casey Hospital		http://wikimapia.org/3853777/Casey-Hospital#/photo/530430

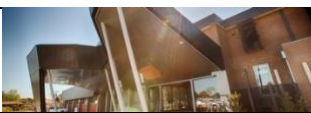
Castlemaine Health		http://www.castlemainehealth.org.au/2014/03/building-redevelopment-project/
Caulfield Hospital/Caulfield General Medical Centre Rehab		https://www.hospitalstays.com.au/hospitals/caulfield-hospital/485
Caulfield Hospital ABI ward		http://www.sth.com.au/Projects/Acquired-Brain-Injury-Rehabilitation-Centre
Dandenong Hospital SW2		https://www.heraldsun.com.au/leader/south-east/dandenong-hospital-mental-health-workers-face-daily-violence-as-ice-synthetic-cannabis-use-rises/news-story/be7801a280fbb2ab839d500d08343c09
Dandenong Hospital W2		https://www.heraldsun.com.au/leader/south-east/dandenong-hospital-mental-health-workers-face-daily-violence-as-ice-synthetic-cannabis-use-rises/news-story/be7801a280fbb2ab839d500d08343c09
Echuca Regional Health		https://www.erh.org.au/departments-and-services/
Golf Links Road Rehabilitation Centre/Frankston Rehabilitation Unit 1		https://www.peninsulahealth.org.au/locations/golf-links-road-rehabilitation-centre/
Golf Links Road Rehabilitation Centre/Frankston Rehabilitation Unit 2		https://www.peninsulahealth.org.au/locations/golf-links-road-rehabilitation-centre/

Goulburn Valley Health (shepparton Campus)		http://www.gvhealth.org.au/goulburn-valley-health-community-advisory-group/
Healesville & District Hospital		https://vhhsba.vic.gov.au/health-infrastructure/healesville-hospital-and-yarra-valley-health
Heidelberg Repatriation Hospital		http://www.austin.org.au/heidelberg-repatriation-hospital
Kingston Centre south		https://www.google.com/maps
Kingston centre northwest		http://monashhealth.org/about-us/monash-health-sites/hospitals-and-major-sites/kingston-centre/
La Trobe Regional Hospital		https://www.abc.net.au/news/2017-12-29/latrobe-regional-hospital-cancels-some-services-after-power-loss/9292830
Mildura Base Hospital		https://www.sunraysiaadaily.com.au/story/5457710/mildura-hospital-the-management-debate-election-tests-private-model/?cs=1889
Northeast Health Wangaratta		https://www.bordermail.com.au/story/5267280/drug-death-after-discharge-reveals-sub-optimal-practices/
Peter James Centre - Eastern Health Inpatient Access Unit		https://www.hospitalstays.com.au/hospitals/the-peter-james-centre-east-burwood/575
Rosebud Hospital/Rosebud Rehabilitation Unit		https://www.peninsulahealth.org.au/locations/rosebud-hospital/

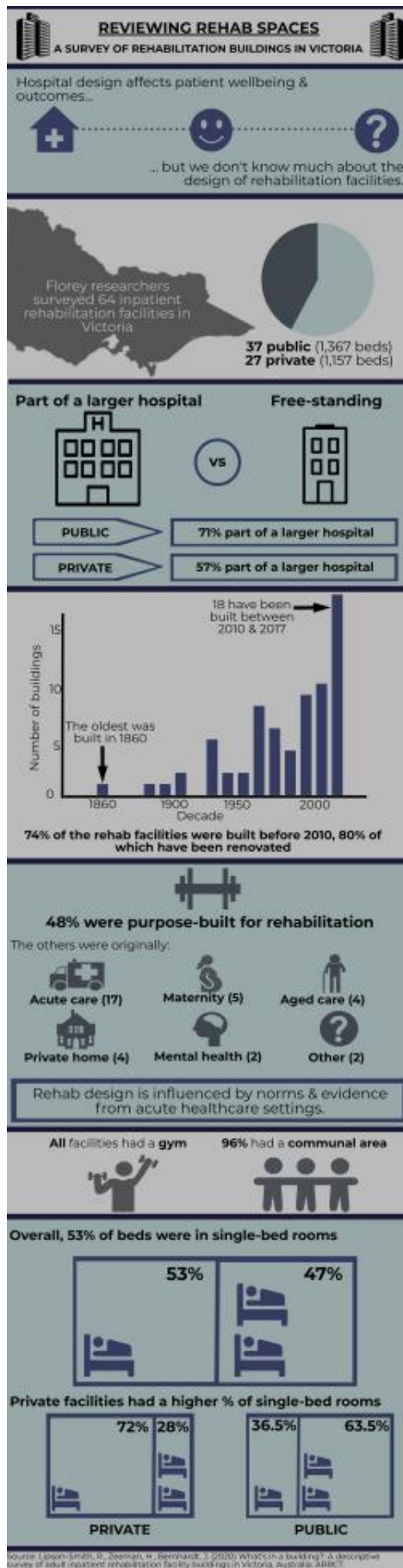
Royal Melbourne Hospital - Royal Park Campus		https://www.film.vic.gov.au/choose-victoria/locations/royal-melbourne-hospital-royal-park-campus
Royal Talbot Rehabilitation Centre		http://www.austin.org.au/royal-talbot-rehabilitation-centre
Royal Talbot Rehabilitation Centre ABI ward		http://www.austin.org.au/mentalhealth/BDP/
South West Health Care Warrnambool		https://swarh2.com.au/swh/content/contact-us.aspx
St George's Health Service		https://www.dailymail.co.uk/news/article-3599258/Australian-hospital-screening-patients-superbug-kill-half-people-infects.html
St Vincent's Hospital (Melbourne)		https://www.svhm.org.au/patients-visitors/campus-information
Sunshine Hospital		http://www.westernhealth.org.au/OurSites/SunshineHospital/Pages/default.aspx
The Mornington Centre		https://www.blp.com.au/portfolio/morningtoncentre/
Werribee Mercy Hospital		https://www.blp.com.au/portfolio/werribeemercyhospital/
Western District Health Service, Hamilton		http://www.visitgreaterhamilton.com.au/western-district-health-service-conference-and-education-centre
Western Hospital Footscray		http://www.westernhealth.org.au/OurSites/WesternHospital/Pages/default.aspx

Williamstown Hospital		http://www.westernhealth.org.au/OurSites/WilliamstownHospital/Pages/default.aspx
Wimmera Health Care Group Horsham/Wimmera Base Hospital (Horsham)		https://www.abc.net.au/news/2012-01-18/wimmera-base-hospital-in-horsham2c-western-victoria/3779908
Yarram & District Health Service		http://www.ydhs.com.au/medical-services/
Beleura Private Hospital		https://www.modscape.com.au/commercial/beleura-private-hospital/
Brunswick Private Hospital		https://www.australianunity.com.au/wealth/investment-options/property/healthcare-property-trust-wholesale/brunswick-hospital-and-house-vic
Cabrini Health Elsternwick Rehabilitation Services - Glenhuntly rd campus		https://www.cabrini.com.au/patients-and-families/facilities-and-directions/rehabilitation-glenhuntly-rd/
Cabrini Hopetoun Rehabilitation Hospital		https://www.cabrini.com.au/patients-and-families/facilities-and-directions/rehabilitation-hopetoun-2/
Cotham Private Hospital		https://www.hospitalstays.com.au/hospitals/cotham-private-hospital/489
Donvale Rehabilitation Hospital		https://www.donvalerehabilitationhospital.com.au/Our-Services/Overview

Dorset Rehabilitation Centre		https://www.hospitalstays.com.au/hospitals/dorset-rehabilitation-centre/496
Epworth Geelong		https://www.epworth.org.au/Our-Hospitals/Epworth-Geelong/Pages/Overview.aspx
Epworth Rehabilitation Brighton		http://www.vitalhealthcareproperty.co.nz/epworth-rehabilitation-brighton
Epworth Rehabilitation Camberwell		https://www.epworth.org.au/our-hospitals/epworth-camberwell/pages/overview.aspx
Epworth Rehabilitation Hawthorn		https://www.epworth.org.au/Our-Hospitals/Epworth-Hawthorn/Pages/Overview.aspx
Epworth Rehabilitation Richmond		https://www.epworth.org.au/Our-Hospitals/Epworth-Richmond/Pages/Overview.aspx
Geelong Private Hospital		http://www.geelongprivatehospital.com.au/
Holmesglen Private Hospital		http://www.healthscopepulse.com.au/news/blog/health-minister-holmesglen-private
Masada Private Hospital - The Bayside Rehabilitation Centre		https://www.nuformsteel.com.au/masda.html
Murray Valley Private Hospital		https://vhd.heritagecouncil.vic.gov.au/places/4938
North Eastern Rehabilitation Centre		http://www.northeasternrehabilitationcentre.com.au/contact-us

Shepparton Private Hospital		https://www.sheppartonprivate.com.au/About-Us/About-Our-Hospital
South Eastern Private Hospital		https://www.signsdandenong.com.au/portfolio/hospital-awning-signs/
St John of God Ballarat Hospital		https://www.ogballarat.com.au/hospitals.html
St John of God Bendigo Hospital		https://www.sjog.org.au/our-locations/st-john-of-god-bendigo-hospital/about/redevelopment
St John of God Frankston Rehabilitation Hospital		https://www.harmer.com.au/wp/portfolio/st-john-of-god-hospital-masterplan/
St John of God Geelong Hospital		https://www.kane.com.au/project/st-john-of-god-geelong-hospital-redevelopment
St John of God Warrnambool Hospital		https://www.standard.net.au/story/628035/patient-intake-soars-to-five-year-high-at-st-john-of-god-warrnambool-hospital/
St Vincent's Private Hospital Melbourne		http://ceoblog.svpm.org.au/behind-the-st-vincent's-private-melbourne-name/
Victorian Rehabilitation Centre (older building)		https://www.melbournepaingroup.com.au/about-us/
Victorian Rehabilitation		http://www.thevictorianrehabilitationcentre.com.au/

Centre (newer building)		
Wangaratta Private Hospital		https://www.hospitalstays.com.au/hospitals/wangaratta-private-hospital/393



Appendix 4: Ethics approval for Study 2

29 June 2017



Dear Claire and Ruby,

I am pleased to advise that the Architecture, Building and Planning Human Ethics Advisory Group has approved the following Minimal Risk Project Version 1.

Project Title: Reframing stroke rehabilitation spaces: The role of learning in recovery and its implications for design evaluation

Researchers: A/Prof W D Imms, Prof T Kvan, Dr K D Fisher, Prof L Churilov, A/Prof C L Newton, Professor J Bernhardt, Miss H D Mitcheltree, R Lipson-Smith

Ethics ID: 1648218.1

The project has been approved for the period: 29 June to 31 December 2017.

It is your responsibility to ensure that all people associated with the project are made aware of what has been approved.

Research projects are normally approved to 31 December of the year of approval. Projects may be renewed yearly for up to a total of five years upon receipt of a satisfactory annual report. If a project is to continue beyond five years, a new application will normally need to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

(a) Limit of approval: Approval is limited strictly to the research as submitted in your project application.

(b) Amendments to project: Any subsequent variations or modifications you might wish to make to the project must be notified formally to the Human Ethics Advisory Group for further consideration and approval before the revised project can commence. If the Human Ethics Advisory Group considers that the proposed amendments are significant, you may be required to submit a new application for approval of the revised project.

(c) Incidents or adverse effects: Researchers must report immediately to the Advisory Group and the relevant Sub-Committee anything which might affect the ethical acceptance of the protocol including adverse effects on participants or unforeseen events that might affect continued ethical acceptability of the project. Failure to do so may result in suspension or cancellation of approval.

(d) Monitoring: All projects are subject to monitoring at any time by the Human Research Ethics Committee.

(e) Annual Report: Please be aware that the Human Research Ethics Committee requires that researchers submit an annual report on each of their projects at the end of the year, or at the conclusion of a project if it continues for less than this time. Failure to submit an annual report will mean that ethics approval will lapse.

(f) Auditing: All projects may be subject to audit by members of the Sub-Committee.

Please quote the ethics registration number and the name of the project in any future correspondence.

On behalf of the Human Ethics Advisory Group, I wish you well in your research.

Yours sincerely,

Professor Paul Walker

Associate Dean Research

Architecture, Building and Planning Human Ethics Advisory Group

Appendix 5: Workshop pre-reading document & workshop summaries for Study 2

The following documents are included in the subsequent pages:

- 1) Workshop 1 pre-reading document (24 pages)
- 2) Workshop 1 summary (21 pages)
- 3) Workshop 2 summary (54 pages)

Reframing stroke rehabilitation spaces

Developing an approach to evaluating the design of
rehabilitation facilities

Workshop handbook

Created by Ruby Lipson-Smith
ruby.lipson-smith@florey.edu.au; 03 9035 7130

A collaborative project between The Learning Environments Applied Research Network (LEaRN) and The Florey Institute of Neuroscience and Mental Health (the Florey).

This project is funded by a seed grant from the Hallmark Ageing Research Initiative (HARI) at the University of Melbourne.

Ruby Lipson-Smith receives a Research Training Program PhD scholarship.

This project has been approved by the Architecture, Building and Planning Human Ethics Advisory Group at the University of Melbourne (ID: 1648218.1).

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1 The purpose of this document

Reading this document will be enough to prepare you for the workshops, how much extra reading you do is up to you. We're hoping that this document will:

1. Get everyone on the same page

We all have different backgrounds and different levels of expertise (see section 2 for a list of who we are). As interdisciplinary researchers we need to make sure that we can be understood by people outside of our field. This document will provide some basic background on stroke and rehabilitation (see section 4), key references (see section 6), and a glossary of common words or jargon specific to the various fields of our interdisciplinary research (see section 7). We'll be adding to this glossary throughout the workshops, so please make a note of any terms that you don't understand, or that you think other people may not understand. This document includes links to websites and further (optional!) reading. Full-text versions of key references have been provided in a zip file (also optional!).

2. Give everyone an idea of what we'll be doing in the workshops

We want you to arrive at the workshops with a basic understanding of their purpose and the methodology that we'll be using (see sections 3 and 5). We also want you to be aware of our timetable for the day so that we can stay on schedule and get down to the good stuff as soon as possible.

2 Who's who

2.1 Research team

Ms Ruby Lipson-Smith: **Workshop facilitator**

Research assistant and PhD student
The Florey Institute of Neuroscience and Mental Health
ruby.lipson-smith@florey.edu.au; 03 9035 7130

Prof Leonid Churilov: **Workshop facilitator**

Research design expert and statistician
The Florey Institute of Neuroscience and Mental Health

Prof Julie Bernhardt

Physiotherapist clinician researcher and head of Stroke Division at The Florey
The Florey Institute of Neuroscience and Mental Health

A/Prof Clare Newton

Architect and researcher at LEaRN
The Melbourne School of Design

A/Prof Kenn Fisher

Education and health planner at LEaRN
The Melbourne School of Design

A/Prof Wesley Imms

Educator and researcher in innovative learning spaces at LEaRN
Melbourne Graduate School of Education

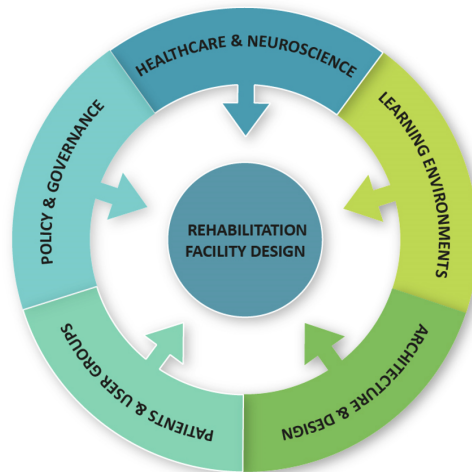
Prof Tom Kvan

Architecture and design processes research at LEaRN
The Melbourne School of Design

Ms Heather Mitcheltree

Hospital and learning environments research at LEaRN
The Melbourne School of Design

2.2 Workshop attendees (aka ‘decision making panel’)



The workshop attendees hail from many diverse disciplines. Image created by Heather Mitcheltree.

Lesley Alway; Director AHDC and nurse; Australian Healthcare Design Council (AHDC).

Katie Bagot; Researcher in stroke and telemedicine, and environmental psychology; The Florey Institute of Neuroscience and Mental Health.

Julie Bernhardt; Physiotherapist clinician researcher and head of Stroke Division at The Florey; The Florey Institute of Neuroscience and Mental Health.

Finn Butler; Wayfinding consultant; Maynard design consultancy.

Ben Cleveland; Educator and research in learning environments at LEARN; The Melbourne School of Design.

Jane Conidaris; Rehabilitation nurse; Austin health.

Maria Crotty *Joining via videoconference*; Rehabilitation physician and researcher; Repatriation General Hospital and Flinders University.

Jo Dane; Architect in education design; Woods Bagot.

Kevin English; Former stroke patient and advocate; The Stroke Foundation.

Kenn Fisher; Education and health planner at LEaRN; The Melbourne School of Design.

Tom Kvan; Architecture and design processes research at LEaRN; The Melbourne School of Design.

Jenna Fivelman *Attending workshop 2 only*; Access consultant, disability volunteer, and architecture student; Flying fox.

Dominik Holzer; Architect and researcher in design and technology; The Melbourne School of Design.

Wesley Imms; Educator and researcher in innovative learning spaces at LEaRN; Melbourne Graduate School of Education.

Jessica Keating; Intern and researcher in neuropsychology; The Florey Institute of Neuroscience and Mental Health.

Warren Kerr; Health architect and researcher; Hames Sharley and University of Western Australia.

Richard Leonard *Attending workshop 2 only*; Architect in education design; Hayball.

Kirra Liu; Research assistant at LEaRN, background in neuropsychiatry; The Melbourne School of Design.

Cody Lyon; Architect and former physiotherapist; Lyons Architecture.

Rob Luxford; Wayfinding consultant; Vivid wayfinding.

Rebecca McLaughlin; Architect and researcher in health environments; The Melbourne School of Design.

Heather Mitcheltree; Hospital and learning environments research in LEaRN; The Melbourne School of Design.

Clare Newton; Architect and researcher at LEaRN; The Melbourne School of Design.

Natalie Pitt; Health architect; Silver Thomas Hanley (STH).

Robert Polglase; Architect and former nurse; The Melbourne School of Design.

Kerryn Rim *Attending workshop 2 only*; Rehabilitation nurse; Austin health.

Alyce Raine; Former stroke patient and allied health assistant student.

Stefano Scalzo; Architect and assistant director of planning and development;
Department of health and human services, VIC.

Michelle Shannon; Physiotherapist and PhD student in health environments; The
Florey Institute of Neuroscience and Mental Health.

Sarah Smith; Architect in education design; Hayball.

Michel Verheem; Wayfinding consultant; IDlab.

Steven Wells *Attending workshop 1 only*; Rehabilitation nurse and horticultural
therapist; Austin Health.

Heidi Zeeman; Neuropsychologist and researcher in health environments; Griffith
University.

3 Project summary

3.1 Rationale

- To improve stroke recovery, rehabilitation spaces should facilitate behaviours that promote neuroplasticity and learning, such as physical activity, motivation, engagement, and repetition.
- Regrettably, most rehabilitation facilities are located in medical settings that may encourage bed-rest and isolation – states which are a barrier to neuroplasticity.
- We currently have no way to evaluate the design of rehabilitation spaces; we don't know what aspects of these spaces may promote or inhibit beneficial behaviours.
- In order to determine what makes a good stroke rehab space, we first need to develop a way to evaluate the design of these spaces.
- This project is a design exercise to develop an approach to evaluating the design of rehab facilities, in the context of our overall objective of improving rehabilitation care for people who have had a stroke.
- This evaluation approach will be developed over 2 workshops.

3.2 Workshop aims

The aim of the workshops is to:

- Develop a structured approach for evaluating the design of inpatient rehabilitation facilities for stroke patients

This will be achieved by:

- Using Value-Focused Thinking to formulate criteria to evaluate a rehabilitation space (and articulate their importance) (WORKSHOP 1)
- Investigating appropriate measures for each of these criteria (WORKSHOP 2)

3.3 Methodology

Over two workshops, the decision-making panel will be guided in using Value-Focused thinking (VFT) (Keeney, 1992) and Multiple Criteria Decision Analysis (MCDA) (Belton & Stewart, 2002) to identify what they value in the design of inpatient stroke rehabilitation, and to describe a suitable approach to evaluating these spaces. As decision-makers in this VFT process, the workshop attendees will:

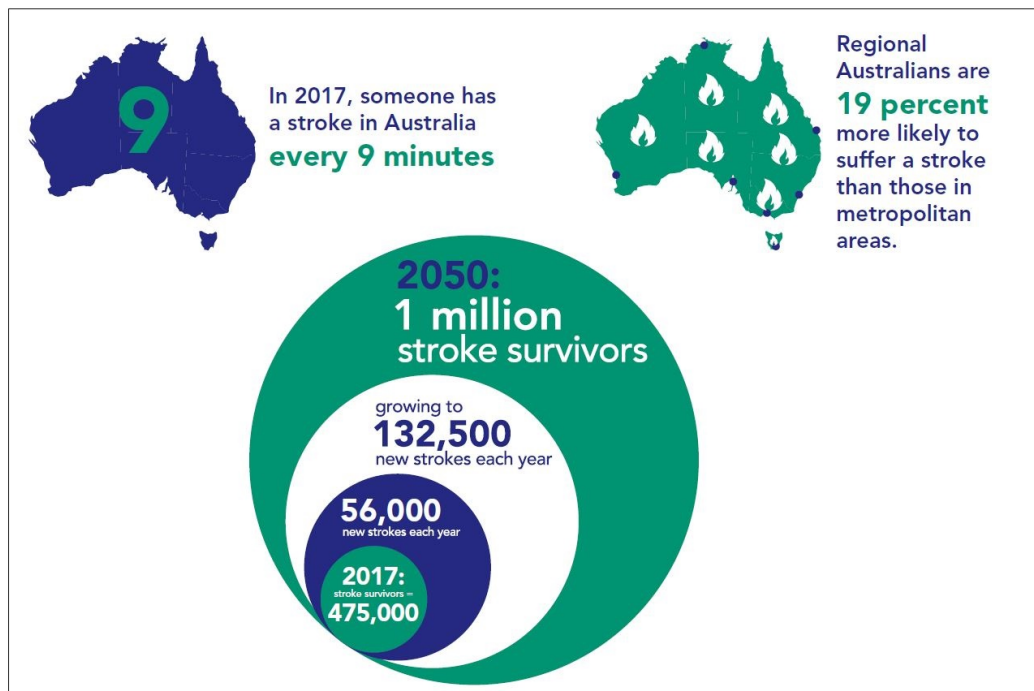
- Think about what they value/want in rehab spaces (these are called *fundamental objectives*), before they think about how to achieve these things (these are called *means objectives*). In VFT, the objectives (also called criteria or attributes) are thought about *before* thinking about the alternative ways in which these objectives could be met (Keeney, 1992) – this allows for unconstrained thinking.
- The workshop attendees will bring together knowledge from three fields – neuroscience, healthcare environments, and learning environments – and will include clinicians, researchers, architects, policy makers, and past patients with experience of stroke rehabilitation.
- Once the evaluation approach has been decided, it will be piloted in an inpatient rehabilitation facility in Melbourne.

4 Background on stroke and rehabilitation

For a brief overview of what a stroke is and the impact that it may have, please read the ‘All about stroke’ fact sheet (Stroke Foundation, 2014) in the zip file of key references that accompanies this handbook.

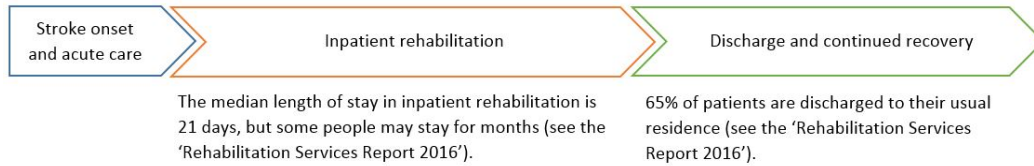
If you would like to do some extra reading, the Stroke Foundation has a plethora of useful resources about stroke prevention, diagnosis, treatment, and life after a stroke on their website (strokefoundation.org.au), and the excellent accompanying website for stroke survivors and their families (enableme.org.au).

The incidence of stroke is predicted to more than double by 2050. Have a read of the ‘No postcode untouched’ publication (Deloitte Access Economics, 2017)(in the zip file of key references) for more information on the prevalence of stroke.



Excerpt from ‘No postcode untouched’ produced by the Stroke Foundation.

Most people who have a stroke will spend time in an acute hospital before moving to inpatient rehabilitation, and then home (see image below). Most people who have had a stroke spend about 3 weeks in inpatient rehabilitation.



The aim of stroke rehabilitation is to help the patient recover by re-learning the skills or abilities that were impacted by the stroke, or by learning how to adapt their life to accommodate these new difficulties as best they can.

Most people who need inpatient rehabilitation following a stroke will be treated in a general rehabilitation ward (i.e, with other, non-stroke patients). For more information about rehabilitation in Australia, have a read of the 'Rehabilitation services report' (Stroke Foundation, 2016) in the zip file of key references.



Rehab bedroom (since decommissioned)



Rehab facility corridor in Melbourne

4.1 What we mean by ‘learning’

In the context of rehabilitation and this research project, learning is defined as **a change in a person’s behaviour or abilities over time as a result of their experience** (this definition is adapted from Mazur, 2013). According to this definition, ‘learning’ is not synonymous with classroom learning or education, rather it describes the process that all humans continually undergo as they adapt to ever changing environments and experiences. We learn to walk, we learn to talk, we learn that smiling makes other people smile back, we learn that berries taste sweet and lemons taste sour, we learn to be quiet in cinemas, we learn to behave a certain way in the workplace, we learn to behave a certain way at home, we learn to behave a certain way in hospitals.

- Whenever we form a new association and learn something new, there is a corresponding chemical or physiological change somewhere in our brain or nervous system. This corresponding change is called *experience-dependent neuroplasticity*.
- Rehabilitation therapy taps into these experience-dependent neuroplastic processes; during therapy, patients practice specific behaviours (e.g., reaching and grasping) to encourage the re-learning of related skills or abilities (e.g., picking up a glass of water).
- We are interested in whether the environment of rehabilitation facilities can promote beneficial behaviour change, either by encouraging incidental practice or by promoting psychological states that motivate patients and support re-learning.

4.2 Hypothetical case studies and patient perspectives

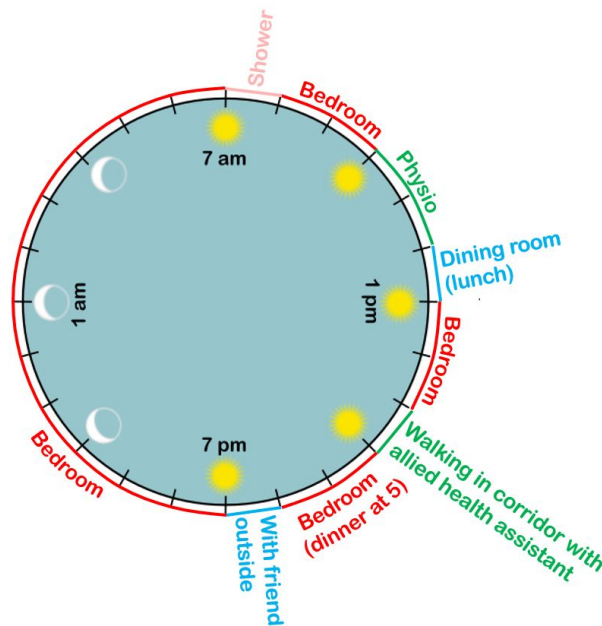
For those of you who do not have a background in stroke, we have included some hypothetical case studies below (based on real data). The case studies give an idea of what a typical day might be like for three different patients in rehabilitation. This information should help you think about how varied and complex patients' needs may be, and the challenges associated with designing an environment for all types of people. In addition to these case studies, you could also look at:

- Many people who have experienced a stroke have shared their stories with the Stroke Foundation. You can read these stories on the (Fight Stroke Stories) section of the Stroke Foundation website.
- Some academic publications that address the patient experiences of rehabilitation have been included in your zip file of further reading, see: 'Boredom in patients with acquired brain injuries during inpatient rehabilitation' (Kenah et al., 2017); 'Stroke survivors' experiences of physical rehabilitation' (Luker et al., 2015); and 'Inactive and alone: physical activity within the first 14 days of acute stroke unit care' (Bernhardt et al., 2004).

4.2.1 Case study one

Susanne is 70 years old and was living alone in her own home before she had a stroke. After the stroke, Susanne's main issue was muscle weakness in her right leg. She was still able to walk without assistance, but it was much more difficult.

- She stayed in rehab for 16 days and did physiotherapy 5 days per week.
- She shared a room with 3 other people.
- Her early goal for rehabilitation was to be able to get her leg working well enough for her to be able to move back into her own home; but her long term goal was to get well enough to get back to her walking group, who are planning a trip to Spain next year.

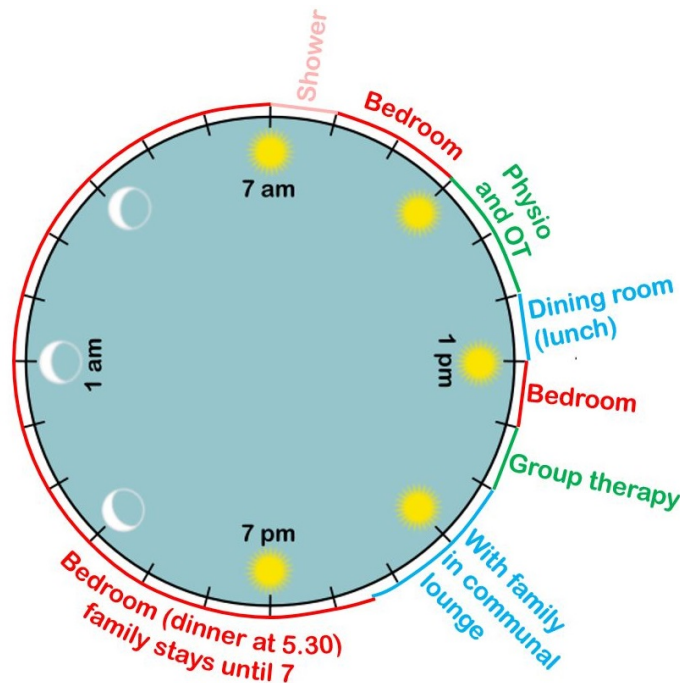


This image shows a typical day for Susanne while she was in rehab.

4.2.2 Case study two

Sarah is 35 years old and was living at home with her husband and son before she had a stroke. After the stroke, Sarah's main issue was severe muscle weakness in her left arm, as well as sensory loss in her left arm and leg, and some attentional neglect. This made it hard for her to be able to walk without assistance, and she couldn't do anything that required both of her arms.

- She stayed in inpatient rehab for 34 days and did physiotherapy and occupational therapy (OT) 5 days each week.
- She shared a room with 1 other person.
- Her goals for rehabilitation were to be able to get her arm working well enough to be able to dress herself and her son, to help at playgroup 2 days each week, and to get back to cooking.

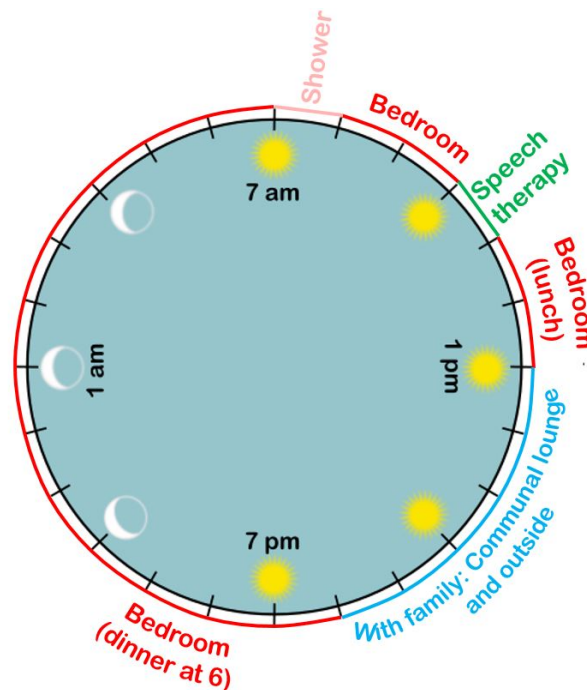


This image shows a typical day for Sarah while she was in rehab.

4.2.3 Case study three

Sayid is 77 years old and was living at home with his family before he had a stroke. After the stroke, Sayid's main issue was aphasia; he had difficulty forming words and some difficulty with comprehending and following commands. This made it very hard for him to communicate his needs, and it was also hard for him to follow instructions in therapy.

- He stayed in inpatient rehab for 13 days where he did speech therapy 5 days per week. After that, he was discharged to outpatient rehabilitation and he came in for speech therapy every working day for another 20 days (luckily, he lived nearby).
- While in inpatient rehab, he shared a room with 3 other people.
- His goal for rehabilitation was to be able to have a normal conversation with his family over dinner.



This image shows a typical day for Sayid while he was in inpatient rehab.

5 The workshops

5.1 Some guidelines for discussion

Here are some things to keep in mind while we are doing the Value-Focused Thinking exercises:

1. Focus on the future, not the past

We want to come up with innovative ideas and solutions. You should still draw on your own experiences, because there may be some aspects of current or past rehab design that will spark ideas for you to consider, but don't feel constrained by previous designs. Instead, think about how these spaces could *ideally* be designed. What might the ideal rehabilitation space of the future be like?

2. Focus on concepts, not features

In these workshops, we want to know the concepts that may drive design (e.g., 'make the space less intimidating'), rather than the design features that may address these concepts (e.g., 'use homely furnishings').

3. Avoid jargon and acronyms

Refer to our glossary when needed, and be sure to make a note of words or phrases that should be added.

4. No gaps and no overlaps

When we are coming up with objectives (aka criteria or attributes) in the Value-Focused Thinking exercises, we want to make sure that no objectives are missed, but we also want to make sure that none are repeated. Imagine that we are putting together a jigsaw puzzle where each piece of the puzzle is a different objective: we want all of the pieces to be accounted for (i.e., no gaps), but we also don't want to have more than one copy of any one piece (i.e., no overlaps). In other words, be mutually exclusive, but collectively exhaustive.



5.2 Schedule: Workshop 1

Wednesday, 25th October 2017, 11am–3.30pm

11:00–11:10	Welcome
11:10–11:30	Presentation: Introduction to Value-Focused Thinking
11:30–11:45	In groups: Practice using Value-Focused Thinking
11:45–12:30	In groups: Brainstorm what you think is important in rehab design
12:30–1:00	LUNCH
1:00–2:30	Bring it all together: Structure criteria generated by each group and then refine
2:30–2:45	TEA/COFFEE BREAK
2:45–3.30	Rank criteria

5.3 Email correspondence between workshops

Ruby may need to contact you via email after Workshop 1 to clarify things discussed in the workshop, or to ask for your advice in regard to certain elements of Workshop 2.

5.4 Schedule: Workshop 2

Tuesday, 28th November 2017, 11am–3.30pm

This workshop will involve the question of how to measure the criteria that we have determined to be important in the design of rehabilitation spaces. The schedule for this workshop will depend on the outcomes of Workshop 1 and will be circulated closer to the date.

6 References

- Belton, V., & Stewart, T. J. (2002). *Multiple Criteria Decision Analysis : An Integrated Approach*: Boston, MA : Springer US.
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- Newton, C., & Fisher, K. (2009). *Take 8: learning spaces: the transformation of educational spaces for the 21st century*. Manuka, ACT: Australian Institute of Architects.
- Stroke Foundation. (2014). All about stroke fact sheet.
- Stroke Foundation. (2016). National Stroke Audit Rehabilitation Services Report. Melbourne, Australia.

7 Glossary

Please add any terms that you don't understand, or that you think other people may not understand.

7.1 Some architecture and design terminology

Some of these definitions have been taken directly from 'Take 8: Learning spaces' (Newton & Fisher, 2009) and adapted for this context.

Word or phrase	Definition
As-built drawings	measured drawings completed after construction, which record the actual built form of the building.
Assemblies	the specific way components are put together in wall, roof, or floor to meet code requirements for fire or load ratings.
Building Code of Australia (BCA)	is a detailed set of regulations specific to the Australian Building Industry
Building fabric	the various construction materials (roof, floor, wall, windows) used in the make-up of a building which directly influence energy efficiency and aesthetics.
Circulation routes	intentional or unintentional paths used by people when navigating around a site or through a building.
Egress	the exit paths for occupants in a building to reach a safe zone.
ESD	this acronym has various interpretations including Environmentally Sustainable Development, Ecologically Sustainable Development, and Education for Sustainable Development.
Learning styles	are simply various approaches to learning along with an understanding that different students have preferences for particular models of learning.
Elevation	in design drawings, this term refers to a scale drawing which depicts the internal or external faades, Elevation can also refer to the height above sea level or ground level.

Word or phrase	Definition
Fenestration	the arrangement of windows in a building.
FFE	furniture, fittings, and equipment.
Flexibility	a problematic term meaning many things from ‘ease of reconfiguration’, to ‘suitable for various different purposes’.
Footprint	the gross first-floor or ground-floor area of a building.
HVAC	used in construction to refer to the Heating, Ventilating, and Air Conditioning of a building.
IAQ and IEQ	Indoor Air Quality is a measure of the air quality, whereas Indoor Environmental Quality is a broader measure of light, heat, acoustics, and general comfort levels.
Orientation	refers to the way a building is positioned in relation to site features, the sun, or compass points
Thermal mass	the ability of a material to absorb heat and store it. High-density materials such as brick, concrete, and stone effectively absorb heat transferred by direct sunlight and then release that energy when the surrounding environment starts to cool down.

7.2 Some stroke and neuroscience terminology

Word or phrase	Definition
Aphasia	is an impairment in the production or comprehension of speech, or in reading or writing. Aphasia can occur if a stroke damages the language areas of someone's brain.
Activities of Daily Living (ADLs)	are routine activities that most people tend to do every day such as eating, getting dressed, bathing, walking.
Clinical outcomes	are measurable changes in health or function.
Cognitive function	involves all aspects of human perception, attention, thinking, language, reasoning, planning, and remembering. This definition of 'cognition' is broader than in education disciplines.
Function and regain of function	function refers to the physiological or psychological functions of body systems. Regain of function is the improvement of functions that were damaged as a result of stroke.
Functional Independence Measure (FIM score)	is a checklist that gives a standard measure of someone's ability to function independently i.e., their level of disability. FIM efficiency is defined as the mean change in FIM score from the beginning to the end of rehabilitation divided by the mean length of stay. The higher the value the greater the level of functional improvement per day.
Inpatient versus outpatient rehabilitation	inpatients are people that have been admitted to a ward in the rehabilitation facility or hospital where they will stay overnight, and receive care and therapy during the day. Outpatients do not stay overnight in the hospital, but visit the gym or clinics for therapy sessions or other appointments.
Length of Stay (LoS)	the amount of time that a patient stays in hospital as an inpatient (usually measured in days).
Neglect	a condition in which people who have had a stroke fail to pay attention to anything on one side of their visual field, usually the left. Also called inattention, attentional neglect, hemispatial neglect, or unilateral neglect.

Word or phrase	Definition
Neuroplasticity	also called neuronal plasticity or brain plasticity. This term refers to the ability of the cells in the brain to change how they communicate with each other, change their structure, and change their function.
Participation	can refer to two things in the context of rehabilitation. A patient's 'level of participation' can describe how involved or engaged they are in rehabilitation therapy; or, a persons' participation levels post-rehabilitation may be used to describe how significantly their disability is impacting their level of involvement in everyday life situations.
Patient-centred care	a term that is difficult to define, but that broadly refers to healthcare or treatment that is organised around the patient and with the patient's preferences taken in to account. Usually described as an alternative to clinician-centred or institution-centred care in which the patient's care is organised around the convenience or wishes of the clinician or institution.
Rehabilitation	is a process of active biological change in the central nervous system by which a person who has become disabled acquires the knowledge and skills needed for optimum physical, psychological and social function. (Definition from the Stroke Recovery and Rehabilitation Roundtable publications.)

7.3 Some education terminology

Some of these definitions have been taken directly from ‘Take 8: Learning spaces’ (Newton & Fisher, 2009) and adapted for this context.

Word or phrase	Definition
Action research	involves the researcher taking an active role as a participant implementing change while simultaneously observing the results.
Assessment versus evaluation	Assessment is the feedback and marking given to students whereas evaluation refers to quality assurance processes to determine how well the programs are doing and what needs to improve.
Authentic learning	allows students to study real-world ideas, problems and issues and to make connections within their learning that are meaningful to them in the present and possible future life circumstances. (Perhaps analogous to goal-directed rehabilitation.)
Cognitive, physical, and socio-emotional skills	In education, cognitive skills refer to intellectual and academic skills such as mathematics, language, and science. (In a rehabilitation context, cognition is a much broader term.) People also develop physical skills such as dexterity and gross motor skills which help them use their bodies effectively. Socio-emotional skills involve effective social skills.
Constructivist pedagogies	posit that there are many ways of constructing meaning and that the role of education is to develop the skills of learning in which students form conceptual understanding through experimentation and collaboration rather than teacher-led instruction. (Perhaps analogous to patient-led rehabilitation.)
‘Deep’ versus ‘surface’ approaches to learning	Deep-holistic learners try to understand the context of a part within a larger structure, whereas a surface learner tends to reproduce a superficial part or segment of a larger context.
Inquiry learning	Is one of the many terms to describe when learning is driven more by the students’ questions than the teachers’ lessons.

Word or phrase	Definition
Learning styles	are simply various approaches to learning along with an understanding that different students have preferences for particular models of learning.
Lifelong learning	has been encouraged through policy by many Western governments as a desirable attribute. Learning is no longer perceived as occurring only in a school or tertiary setting.
Metacognition	is the ability to know about knowing or the ability to know which learning strategies are best to solve particular problems.
Pedagogy	is the art or profession of teaching based on principles and practice.
Problem-based learning (PBL)	is a technique in which students collaborate on challenging and open-ended problems in small groups drawing on their experiences. Teachers take a role as facilitators encouraging students to direct their own learning processes. (Perhaps analogous to group therapy sessions in rehabilitation.)
Scope and sequence	is where the breadth and depth and parameters of learning are outlined.

Reframing stroke rehabilitation spaces

Developing an approach to evaluating the design of
rehabilitation facilities

Post-workshop 1 summary

Created by Ruby Lipson-Smith
ruby.lipson-smith@florey.edu.au; 03 9035 7130

A collaborative project between The Learning Environments Applied Research Network (LEaRN) and The Florey Institute of Neuroscience and Mental Health (the Florey).

This project is funded by a seed grant from the Hallmark Ageing Research Initiative (HARI) at the University of Melbourne.

Ruby Lipson-Smith receives a Research Training Program PhD scholarship.

This project has been approved by the Architecture, Building and Planning Human Ethics Advisory Group at the University of Melbourne (ID: 1648218.1).

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1 The purpose of this document

Like the minutes from a meeting, this document will provide a brief summary of what was discussed in the first 'reframing stroke rehabilitation spaces' workshop (held on October 25th 2017).

2 Workshop attendees

2.1 Facilitators

Ruby Lipson-Smith; Research assistant and PhD student; The Florey Institute of Neuroscience and Mental Health; ruby.lipson-smith@florey.edu.au; 03 9035 7130
Leonid Churilov; Research design expert and statistician; The Florey Institute of Neuroscience and Mental Health

2.2 Summer table

Lesley Alway; Director AHDC and nurse; Australian Healthcare Design Council (AHDC).
Julie Bernhardt; Physiotherapist clinician researcher and head of Stroke Division at The Florey; The Florey Institute of Neuroscience and Mental Health.
Ben Cleveland; Educator and research in learning environments at LEARN; The Melbourne School of Design.
Alyce Raine; Former stroke patient and allied health assistant student.
Robert Polglase; Architect and former nurse; The Melbourne School of Design.
Sarah Smith; Architect in education design; Hayball.

2.3 Autumn table

Kevin English; Former stroke patient and advocate; The Stroke Foundation.
Dominik Holzer; Architect and researcher in design and technology; The Melbourne School of Design.

Wesley Imms; Educator and researcher in innovative learning spaces at LEaRN; Melbourne Graduate School of Education.

Warren Kerr; Health architect and researcher; Hames Sharley and University of Western Australia.

Heather Mitcheltree; Hospital and learning environments research in LEaRN; The Melbourne School of Design.

Michelle Shannon; Physiotherapist and PhD student in health environments; The Florey Institute of Neuroscience and Mental Health.

2.4 Winter table

Katie Bagot; Researcher in stroke and telemedicine, and environmental psychology; The Florey Institute of Neuroscience and Mental Health.

Jane Conidaris; Rehabilitation nurse; Austin health.

Jo Dane; Architect in education design; Woods Bagot.

Tom Kvan; Architecture and design processes research at LEaRN; The Melbourne School of Design.

Kirra Liu; Research assistant at LEaRN, background in neuropsychiatry; The Melbourne School of Design.

Rob Luxford; Wayfinding consultant; Vivid wayfinding.

Heidi Zeeman; Neuropsychologist and researcher in health environments; Griffith University.

2.5 Spring table

Maria Crotty *Joined via videoconference*; Rehabilitation physician and researcher; Repatriation General Hospital and Flinders University.

Jessica Keating; Intern and researcher in neuropsychology; The Florey Institute of Neuroscience and Mental Health.

Rebecca McLaughlan; Architect and researcher in health environments; The Melbourne School of Design.

Clare Newton; Architect and researcher at LEaRN; The Melbourne School of Design.

Natalie Pitt; Health architect; Silver Thomas Hanley (STH).

Stefano Scalzo; Architect and assistant director of planning and development;
Department of health and human services, VIC.

Michel Verheem; Wayfinding consultant; IDlab.

Steven Wells *Attending workshop 1 only*; Rehabilitation nurse and horticultural
therapist; Austin Health.

2.6 Apologies

Kylie Brown; Architect; Lyons Architecture.

Finn Butler; Wayfinding consultant; Maynard design consultancy.

Kenn Fisher; Education and health planner at LEaRN; The Melbourne School of
Design.

Richard Leonard; Architect in education design; Hayball.

Cody Lyon; Architect and former physiotherapist; Lyons Architecture.

3 What we did in workshop 1

In the first workshop, we split into four groups and used Value-Focused Thinking (Keeney, 1992) to define what we thought would be desirable in the optimal design of a stroke rehabilitation building. Over a number of iterations, each group created a hierarchy of the attributes that they thought were most important (their 'fundamental objectives'), and listed some of the ways in which these attributes could be achieved ('means objectives'). This was the first step in achieving our overall aim for the workshops, which is to develop a structured approach for evaluating the design of inpatient rehabilitation facilities for stroke patients.

3.1 The hierarchies developed by each group

After practising using Value-Focused Thinking, we applied it to our decision problem in question, namely: What are the desirable attributes in the design of stroke inpatient rehabilitation buildings?

Each table began by brainstorming things that they thought would be important in achieving the optimal design for stroke rehab learning. They then iteratively refined this list and distilled it by interrogating each objective using the four questions in the figure below and organising the list into a hierarchy.

	Fundamental objectives	Means objectives
To move: Ask:	Downward in the hierarchy: <i>"What do you mean by that?"</i>	Away from fundamental objectives: <i>"How could you achieve this?"</i>
To move: Ask	Upward in the hierarchy: <i>"Of what more general objective is this an aspect?"</i>	Towards fundamental objectives: <i>"Why is this important?" (WITI)</i>

These four questions can be used to refine objectives, identify fundamental objectives, and organise them into a hierarchy (Clemen & Reilly, 2001, pg. 49)

3.1.1 Summer group's hierarchy

The hierarchy developed by the summer group is shown in the photo below and in the typed flowchart on the following page.

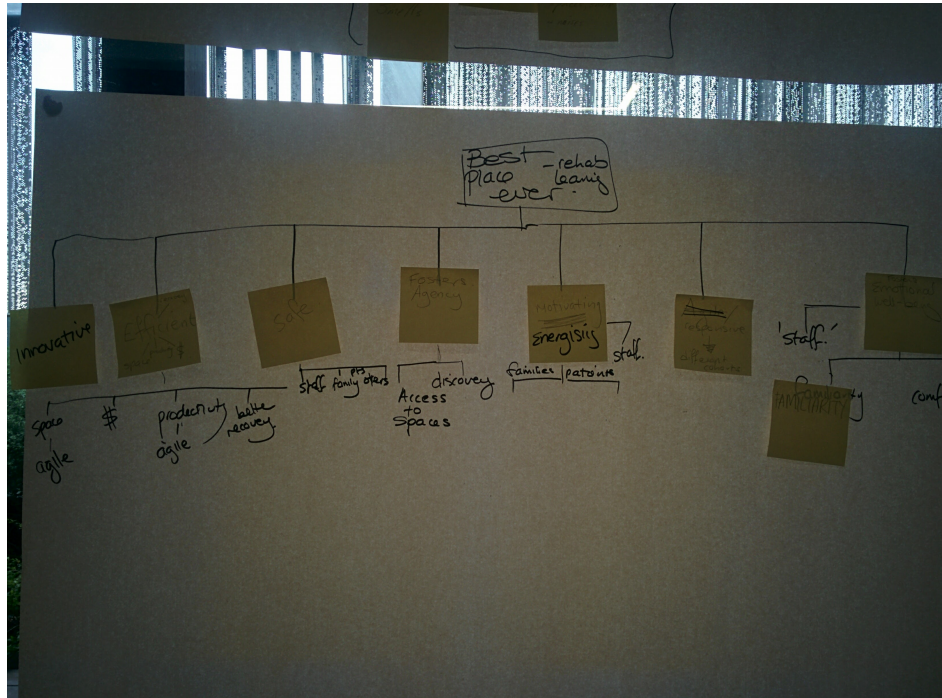
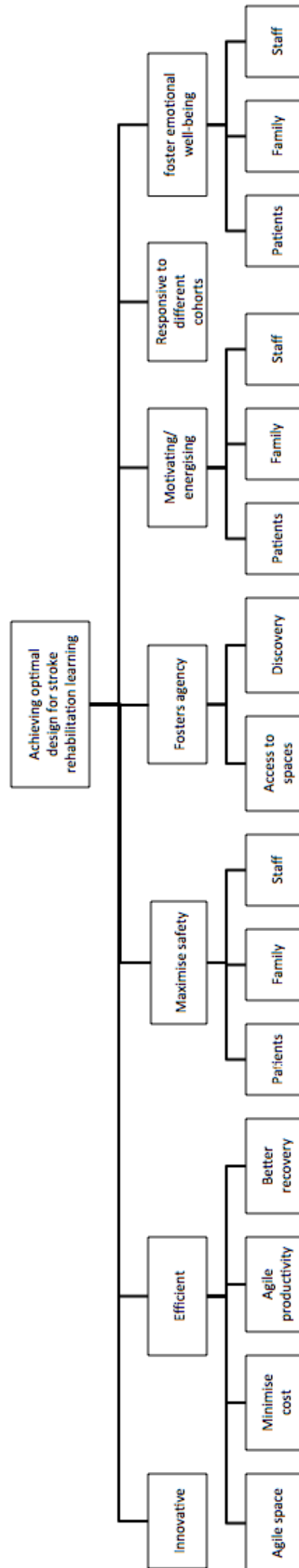


Photo of the hierarchy developed by the summer group



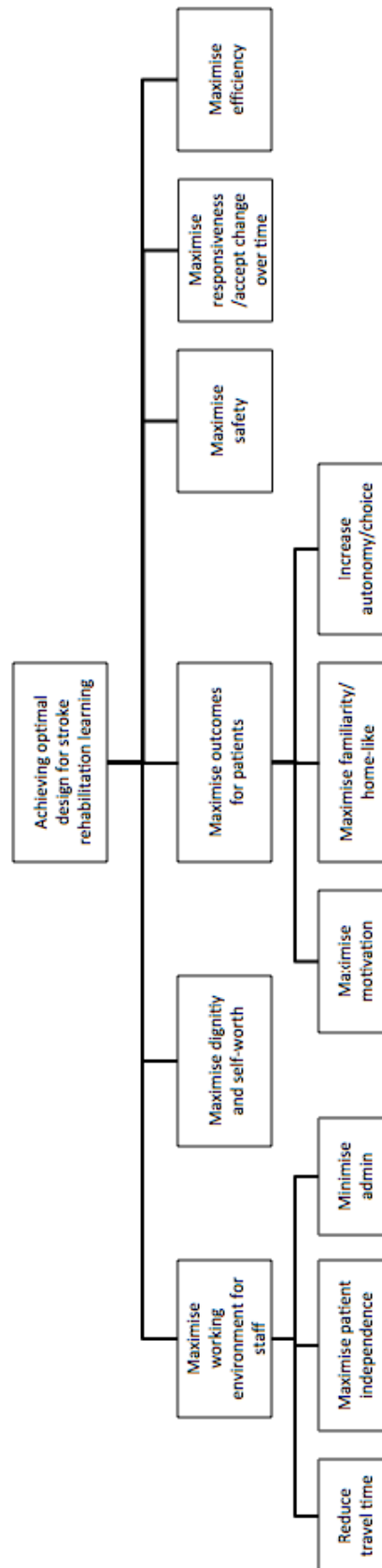
Typed copy of the hierarchy developed by the summer group. Only the fundamental objectives are shown (not the means objectives).

3.1.2 Autumn group's hierarchy

The hierarchy developed by the autumn group is shown in the photo below and in the typed flowchart on the following page.



Photo of the hierarchy developed by the autumn group



Typed copy of the hierarchy developed by the autumn group. Only the fundamental objectives are shown (not the means objectives).

3.1.3 Winter group's hierarchy

The hierarchy developed by the winter group is shown in the photo below and in the typed flowchart on the following page.

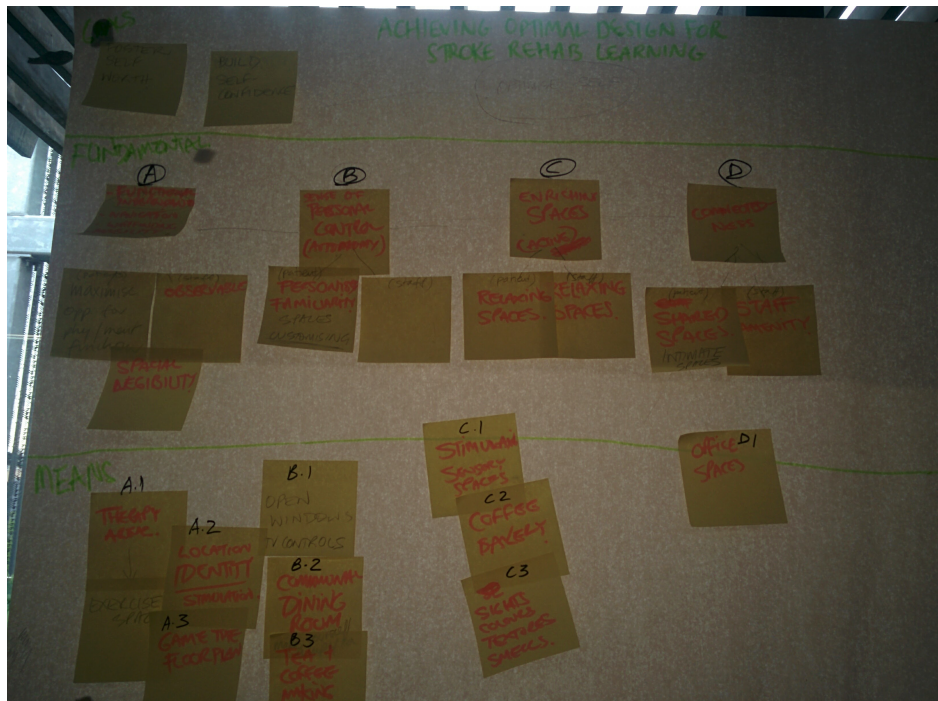
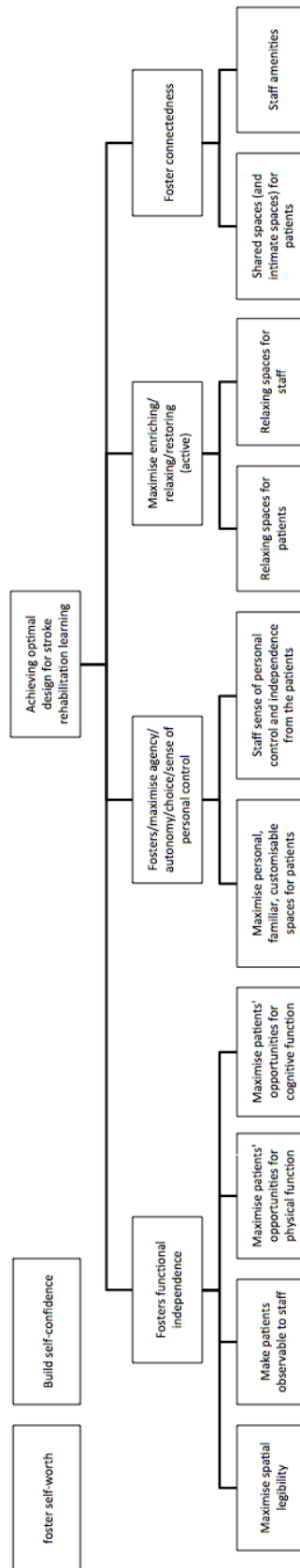


Photo of the hierarchy developed by the winter group



Typed copy of the hierarchy developed by the winter group. Only the fundamental objectives are shown (not the means objectives).

3.1.4 Spring group's hierarchy

The hierarchy developed by the spring group is shown in the photo below and in the typed flowchart on the following page.

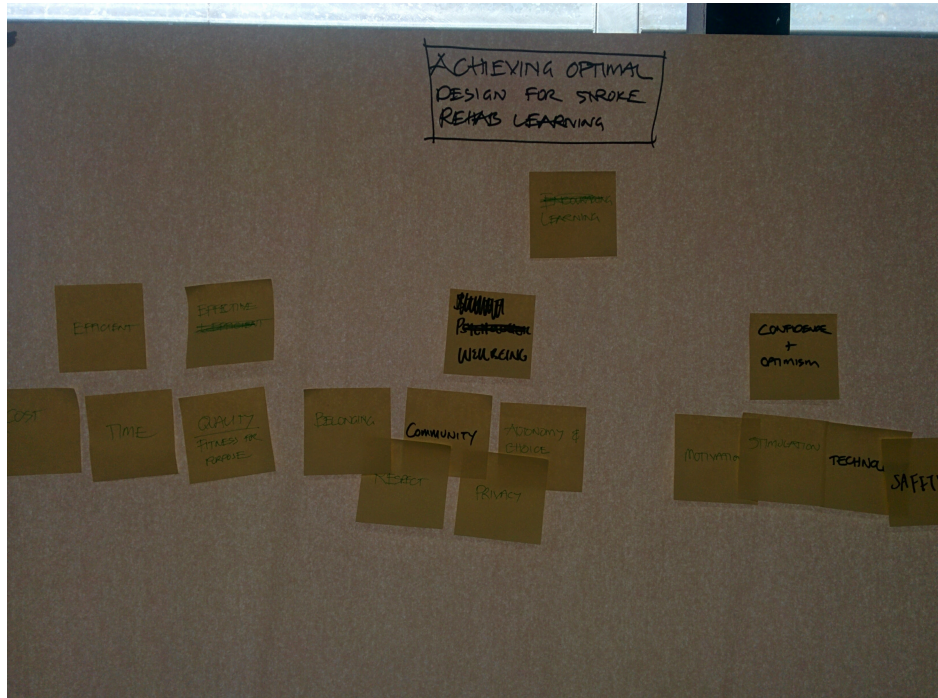
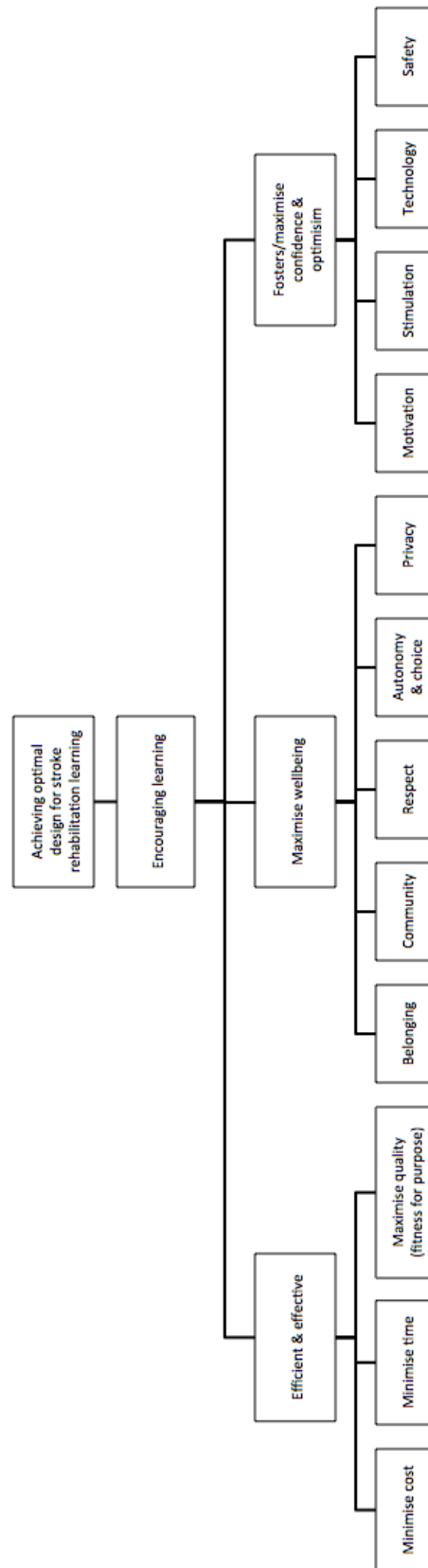


Photo of the hierarchy developed by the spring group



Typed copy of the hierarchy developed by the spring group. Only the fundamental objectives are shown (not the means objectives).

3.2 The synthesised hierarchy

After the workshop, the four hierarchies were combined to produce one overall hierarchy. This hierarchy represents what experts value in the design of an optimal building for inpatient stroke rehabilitation.

In synthesising the four hierarchies, emphasis was given to making sure that there was no gaps and no overlaps. Some criteria that had been suggested as fundamental objectives were reconsidered as means objectives, since they could facilitate meeting other, more important, objectives (e.g., ‘maximising patients’ motivation’ was reconsidered a means to ‘maximising opportunities for physical function’ and so was labelled a means objective).

3.2.1 The fundamental & means objectives

The synthesised hierarchy has four ‘top tier’ fundamental objectives, each of which has two or three ‘second tier’ fundamental objectives within it. The four top tier fundamental objectives are: Maximise efficiency; Maximise effectiveness; Foster emotional well-being; Maximise safety. There are many means objectives that could be used to achieve the fundamental objectives in this hierarchy, and most of these means objectives could be used to achieving more than one of the fundamental objectives. The hierarchy of fundamental objectives, and the corresponding network of means objectives, is explained in text below and then displayed in a flowchart image.

1. Maximise efficiency A fundamental objective of a rehab building is that it is efficient. This means that the building should encourage minimal spending (i.e., minimal cost), minimal time loss, and should maximise the responsiveness of the space. This criteria of the ‘responsiveness of space’ encompass the idea that design of a rehab facility should be agile and respond to the needs of particular cohorts, and to the changing needs of one patient over time. It also suggests that spaces should be versatile and re-usable where possible.

Some possible means objectives for these fundamental objectives are:

- Reduce travel times

- Minimise admin for staff
- Maximising versatility/agility of space
- Having customisable spaces
- Maximising reusability of space
- Maximising ability of space to change over time
- *Any more that you would like to add? Please email Ruby with suggestions...*

2. Maximise effectiveness i.e., maximise outcomes for patients A fundamental objective of a rehab building is that it maximises the outcomes for the patients. In other words, we want to maximise the patients' recovery - some groups referred to recovery as learning. If we break this down: We think that it is important to maximise patients functional recovery, which means maximising their opportunities for incidental and deliberate practice of physical and cognitive function.

Some possible means objectives for these fundamental objectives are:

- Having legible spaces i.e., good navigation and wayfinding
- Having stimulating/energising spaces
- Having green and/or outdoor spaces
- Having unpredictable spaces
- Having accessible spaces i.e., allowing patients' access to all areas and catering for all levels of mobility
- Having shared spaces
- *Any more that you would like to add? Please email Ruby with suggestions...*

3. Foster emotional well-being A fundamental objective of a rehab building is that it fosters the emotional well-being of the patients, family, and staff within it. The term 'emotional well-being' should encompass all feelings about one's self and one's surroundings including feelings of self-confidence, self-worth, belonging, optimism,

happiness, dignity, and a sense of control. Critically, by fostering emotional well-being, cognitive or emotional states such as boredom, anxiety, and stress should be minimised. The second tier indicates that we are interested in fostering emotional well-being in patients, family/visitors, and staff. It's important to make this distinction because there may be different means to achieving this fundamental objective for these different groups of people (i.e., patients may respond to different things in the built environment than staff) so all three groups would need to be taken into account when design choices are being made.

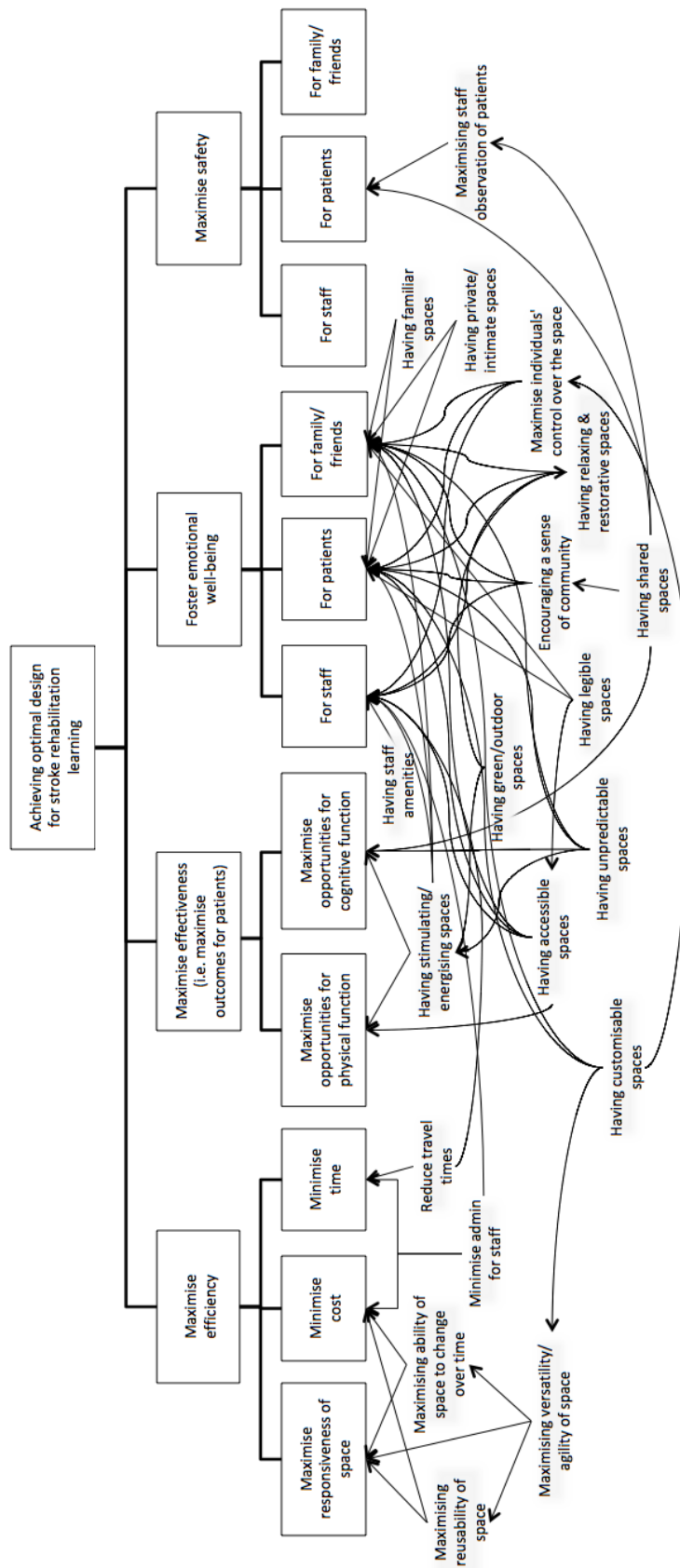
Some possible means objectives for these fundamental objectives are:

- Reduce travel times
- Minimise admin for staff
- Having staff amenities
- Having customisable spaces
- Maximising individuals' control over the space
- Having legible spaces i.e. good navigation and wayfinding
- Having stimulating/energising spaces
- Having green and/or outdoor spaces
- Having unpredictable spaces
- Having accessible spaces i.e. allowing patients' access to all areas and catering for all levels of mobility
- Having shared spaces
- Encouraging a sense of community
- Having relaxed/restorative spaces
- Having familiar spaces
- Having private/intimate spaces
- *Any more that you would like to add? Please email Ruby with suggestions...*

4. Maximise safety A fundamental objective of a rehab building is that it maximises the safety of all of the people within it - the safety of patients, family/visitors, and staff needs to be taken into account in the design of the building.

Some possible means objectives for these fundamental objectives are:

- Maximising staff observation of patients
- Having shared spaces
- *Any more that you would like to add? Please email Ruby with suggestions...*



The synthesised hierarchy of fundamental objectives and the corresponding network of means objectives

4 Next steps

4.1 Before the next workshop

If you feel that there any changes need to be made to the fundamental objectives in the synthesised hierarchy, then please email Ruby before the second workshop. (We will have a chance to review the means objectives during Workshop 2, but the fundamental objectives will need to be finalised before the workshop.)

Also, have a think about how the fundamental objectives in the synthesised hierarchy could be measured/evaluated. If there is no straightforward way of measuring one of the fundamental objectives, then one of its key means objectives could be measured instead. Do you know of any existing measurement tools that could be used for the fundamental or means objectives in the synthesised hierarchy. Please email Ruby with suggestions.

4.1.1 At the next workshop

During Workshop 2, the workshop attendees will be asked to articulate the importance of each of the objectives in the synthesised hierarchy by ranking them using Multiple Criteria Decision Analysis (MCDA) (Belton & Stewart, 2002). The group will then review and expand the network of means objectives before considering different measurement tools that may be appropriate for each of the objectives in the hierarchy.

5 References

- Belton, V. & Stewart, T. J. (2002). *Multiple Criteria Decision Analysis : An Integrated Approach*: Boston, MA : Springer US.
- Clemen, R. T. & Reilly T. (2001). *Making hard decisions with decision tools*: Pacific Grove, CA : Duxbury Thompson Learning.
- Keeney, R. L. (1992). *Value-focused thinking : a path to creative decisionmaking*: Cambridge, MA : Harvard University Press.

6 New additions to the glossary

A few discipline-specific terms came up during the workshop that needed defining. These are listed below along with their definitions. This list is in addition to the initial glossary in the Workshop Handbook (which was circulated before workshop 1).

Word or phrase	Definition
Flexible spaces or adaptable spaces	These terms are used in architecture to describe spaces that are designed to provide for or perform multiple functions. These terms are often used to describe education spaces that are non-traditional or multi-purpose and that encourage collaboration and group-work.
Lean thinking (or lean learning)	Lean thinking describes a way of organising activities to make them more efficient - maximising benefit and eliminating waste. Lean learning is this methodology as applied to education reducing complex learning goals into achievable steps.
Enriched environments versus enriching environments	In rehabilitation, the term 'enriched environment' is used to refer to a stimulating environment that provides lots of extra opportunities for cognitive, social, and physical activity. This term comes from animal models of rehabilitation where mice or rats are housed in 'enriched' enclosures with more toys and more fellow animals. Conversely, some people may use the term 'enriching environment' to describe an environment that is relaxing and restorative (i.e. it enriches the spirit), rather than stimulating.

Reframing stroke rehabilitation spaces

Developing an approach to evaluating the design of
rehabilitation facilities

Post-workshop 2 summary

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A collaborative project between The Learning Environments Applied Research Network (LEaRN) and The Florey Institute of Neuroscience and Mental Health (the Florey).

This project is funded by a seed grant from the Hallmark Ageing Research Initiative (HARI) at the University of Melbourne.

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1 The purpose of this document

Like the minutes from a meeting, this document will provide a summary of what was discussed in the second 'reframing stroke rehabilitation spaces' workshop (held on November 28th 2017). It should be read in conjunction with the summary document from the first workshop (held on October 25th 2017).

2 Workshop attendees

2.1 Facilitators

Ruby Lipson-Smith; Research assistant and PhD student; The Florey Institute of Neuroscience and Mental Health; ruby.lipson-smith@florey.edu.au; 03 9035 7130.

Leonid Churilov; Decision scientist and statistician; The Florey Institute of Neuroscience and Mental Health.

2.2 Summer table

Julie Bernhardt; Physiotherapist clinician researcher and head of Stroke Division at The Florey; The Florey Institute of Neuroscience and Mental Health.

Ben Cleveland; Educator and researcher in learning environments at LEaRN; The Melbourne School of Design.

Kevin English; Former stroke patient and advocate; The Stroke Foundation.

Robert Polglase; Architect and former nurse; The Melbourne School of Design.

2.3 Autumn table

Finn Butler; Wayfinding consultant; Maynard design consultancy.

Jessica Keating; Intern and researcher in neuropsychology; The Florey Institute of Neuroscience and Mental Health.

Alyce Raine; Former stroke patient and allied health assistant student.

2.4 Winter table

Kerryn Rim; Rehabilitation nurse; Austin health.

Sarah Smith; Architect in education design; Hayball.

Heidi Zeeman; Neuropsychologist and researcher in health environments; Griffith University.

2.5 Spring table

Bella Bower; Architect and researcher at LEARN; The Melbourne School of Design.

Maria Crotty; Rehabilitation physician and researcher; Flinders Medical Centre and Flinders University.

Dominik Holzer; Architect and researcher in design and technology; The Melbourne School of Design.

Michel Verheem; Wayfinding consultant; IDlab.

3 What we did in workshop 2

In the second workshop, we reviewed the hierarchy of fundamental objectives that were developed in Workshop 1 and then ranked them in order of importance (experts who attended Workshop 1, but not Workshop 2, did this step via email). This is described in section 3.1 below. Workshop 2 attendees then used Value-Focused Thinking (Keeney, 1992) to describe and refine a network of 'means objectives', i.e., the ways in which the fundamental objectives could be achieved (see section 3.2). Finally, we brainstormed what sorts of methods or tools could be used to measure or evaluate each of the fundamental objectives (see section 3.3). The next step is to combine these tools to create a structured approach for evaluating the design of inpatient rehabilitation facilities for stroke patients (see section 4).

3.1 The ranked importance of the fundamental objectives

Ranking objectives indicates which values should be prioritised, and it is useful when it comes to comparison between two alternatives. For example, imagine that one rehabilitation facility has excellent design innovations to ensure patient safety, while another facility has been designed to promote patients' physical activity but is not that great when it comes to safety. Knowing which of these values (i.e., safety or physical activity) is the most important in a rehab setting would allow a statement to be made about which facility's design is better than the other.

Each of the experts who attended either one or both of Workshop 1 and Workshop 2 individually ranked the fundamental objectives in what they considered to be their order of relative importance. The individual rankings were either completed during Workshop 2 or, if the expert did not attend Workshop 2, they were completed via email. Figure 1 shows an excerpt of the template used to complete the rankings.

Overall hierarchy: Top tier

Thinking about achieving the overall optimal design for stroke rehab:

Rank the objectives below between 1 and 4, where 1 is most important and 4 is least important.

You can give the same ranking to more than one criteria if you want.

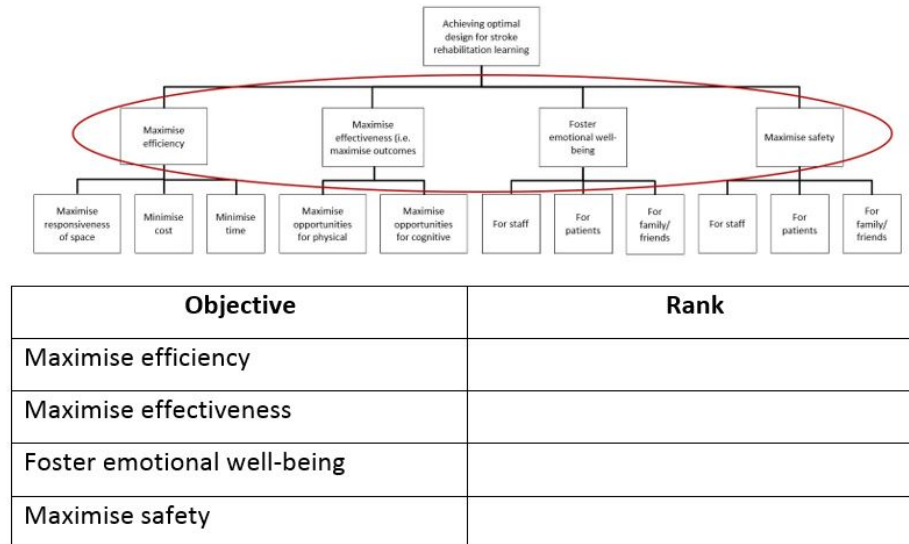


Figure 1: An excerpt from the template used to complete the individual rankings.

After all the individual rankings had been completed, these scores were combined and averaged to produce an overall group ranking of the relative importance of each of the fundamental objectives.

3.2 The network of means objectives

A network of means objectives had been drafted following Workshop 1. This draft was used as a starting point during workshop 2. The group collectively reviewed each of the draft means objectives in turn, identified whether it should be removed, expanded, or combined with another means objective, and described how it might impact on the other (fundamental and means) objectives. Through this process, missing means were identified and added to the network. During this group discussion, the emerging network of means objectives was mapped out on the whiteboard (see Figure 2).

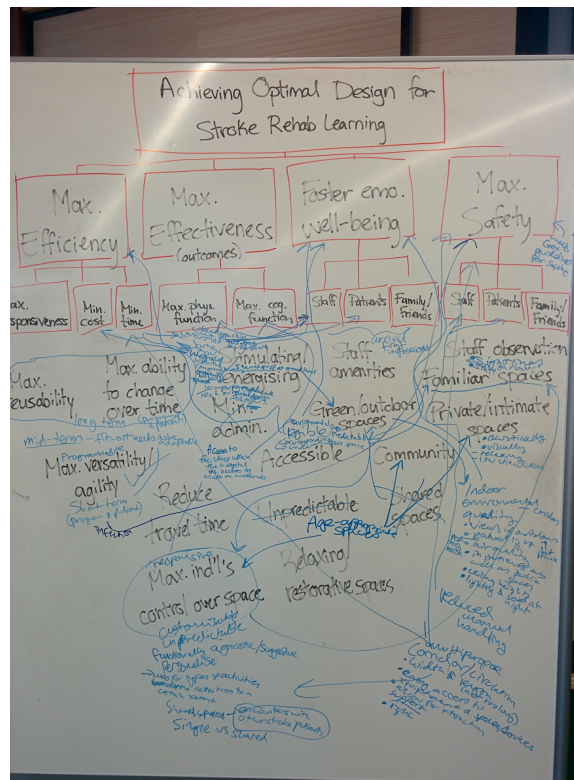


Figure 2: Whiteboard notes taken during the brainstorming process in which the network of means objectives was discussed and refined.

After Workshop 2, the whiteboard notes in Figure 2 and the audio-recordings of the group discussion were used to create a clean version of the means network (see Figure 3), and to develop definitions for each the means objectives (see sections 3.2.1 to 3.2.13 to read these definitions in full). There were thirteen means objectives in the final network.

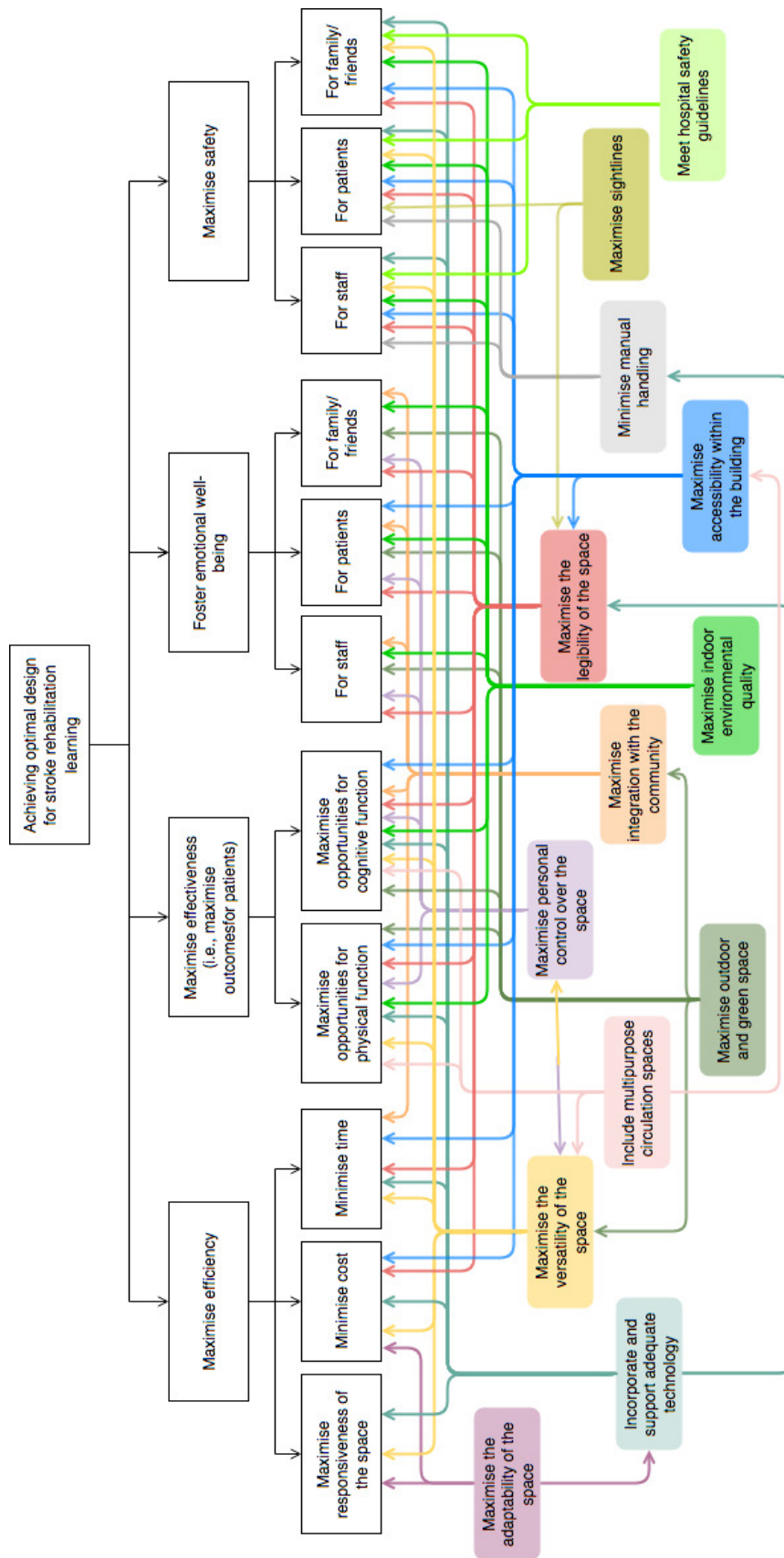


Figure 3: The final hierarchy of fundamental objectives (in black and white) and network of means objectives (in colour). Arrows show expected causal relationships between objectives. Each means objective is defined in sections 3.2.1 to 3.2.13.

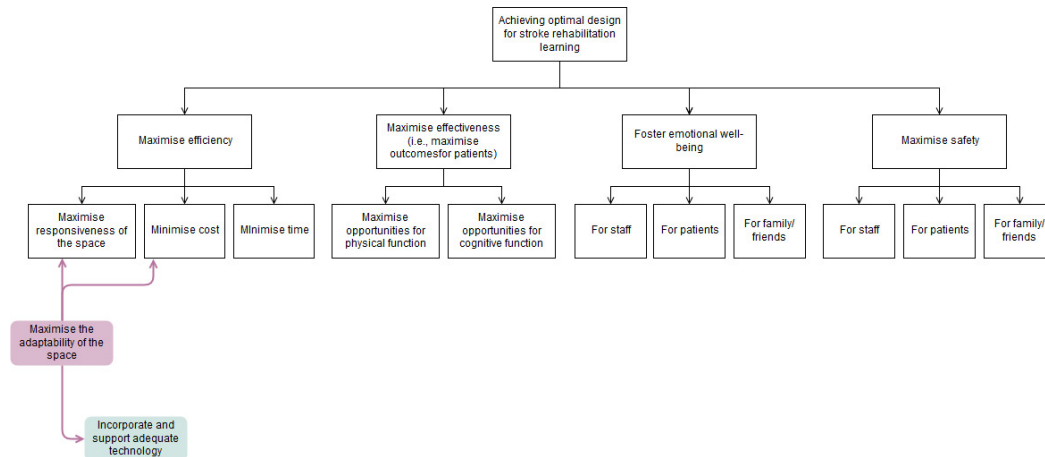
3.2.1 Means objective 1: Maximise the adaptability of the space

In this context, the adaptability of a space refers to its ability to change in response to new knowledge or requirements, both at the level of the clinical program and at the level of the patient. This definition of adaptability refers to changes that occur over the long-term (i.e., years or decades) and the mid-term (i.e., months or years) timescales, but not the short-term timescale (hours or days).

‘Maximising the adaptability of the space’ incorporates the concept of future proofing. Future proofing is important because clinical practices and programs are likely to change as we discover more about neuroplasticity and recovery; new technologies will be developed to support these clinical processes and streamline administration; patient demographics will change as the global population ages; and new research will emerge about the impact of design on mood, behaviour, and brain repair. We need buildings that are flexible enough to respond to these changes. For example, what if medical breakthroughs mean that all rehabilitation in the future can be delivered through outpatient services? Or what if new clinical guidelines recommend that all therapy is delivered as group therapy? We need rehabilitation buildings that can remain vital and useful even as their requirements change.

This concept of adaptability applies to both the fabric of the building (i.e. the overall layout and structure), and the internal fit-out of the building (i.e. the interior design, partitions, etc.).

Perhaps stroke rehabilitation buildings could even be designed with a future, secondary purpose in mind.



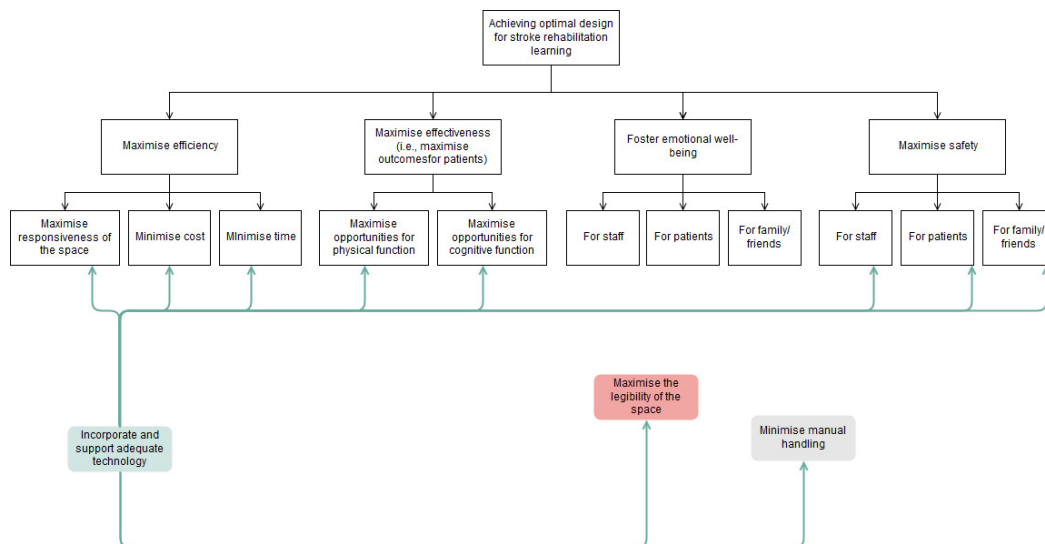
This objective is a means to:

- **Maximise the responsiveness of space** – An adaptable space will be responsive to changing needs and requirements over the mid- and long-term.
- **Minimise cost** – Mid- and long-term costs are reduced if the building is designed from the outset to be able to adapt to changing requirements.
- **Incorporate and support adequate technology** – An adaptable space will allow for unprecedented knowledge growth and facilitate the introduction of new technologies.

3.2.2 Means objective 2: Incorporate and support adequate technology

A stroke rehabilitation facility should be designed to support the necessary technologies for administration and clinical practice, and the design should be flexible enough to adapt as these technologies evolve. In other words, the physical space needs to be designed to align with the technology. Many different forms of technology need to be considered including (but not limited to): Medical apparatuses, gym and therapy equipment, staff computers, public computers, staff and patients' personal devices (phones, tablets, laptops, etc.), pager systems, WiFi and mobile network signals, duress systems, and patient entertainment devices.

Illustrative examples: 1) If the WiFi is strongest in e.g. the corridors then people will congregate there, causing an accessibility problem and fire hazard, and the spaces designed for congregation will not be used. The WiFi signal should be accessible in all areas. 2) The placement of nurses stations, and the presence of computers at these stations, can influence how frequently medical records are updated and can impact on staff travel times within the building. 3) Swipe card access to certain areas of the building can impact on accessibility and patients' personal control over the space, but may also need to be considered in some areas to ensure safety.



This objective is a means to:

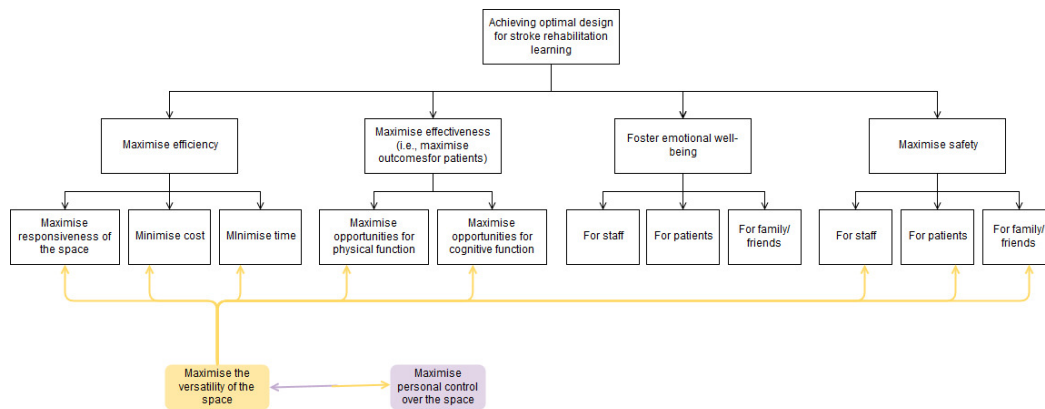
- **Maximise the responsiveness of space and Minimise cost and Minimise time** – There are many technological solutions designed to save time for staff, reduce costs, or make a space more responsive to the needs of its inhabitants (e.g., smart rooms). The building should support inclusion of these evidence-based technologies to improve efficiency.
- **Maximise opportunities for practice of physical function and cognitive function** – There are many new technologies (e.g., robotics, interactive computer games, VR, etc.) designed to assist in the practice of physical and cognitive functions. The building should support inclusion of these evidence-based technologies to improve the effectiveness of therapy.
- **Maximise safety for staff and patients and family/friends** – The building should accommodate the technologies designed to maximise safety (e.g., duress systems, floor sensors for falls risk, smoke alarms).
- **Minimise manual handling** – Adequate technology (e.g., hoists) can minimise the need for staff to manually handle patients.
- **Maximise the legibility of the space** – Technology such as touch-screen information kiosks, and apps that provide information about the facility can support wayfinding.

3.2.3 Means objective 3: Maximise the versatility of the space

The versatility of a space refers to its ability to change over the short-term (i.e., hours or days) in response to day-to-day changes in clinical programs or to meet the immediate needs of different people. In other words, the building should have a loose enough fit so that it works for all users. The versatility of a space is important in regard to changes both at the level of the clinical program and at the level of the individual (patient, staff member, or visitor).

There is a distinction between the ‘adaptability’ and the ‘versatility’ of space, where ‘adaptability’ refers to the ability of the space to adapt or be adapted over the long- or mid-term in response to gradual or global changes, and ‘versatility’ refers to the ability to change or be changed over the short-term in response to immediate or individual needs or preferences. This distinction is something that is used in education facility design.

‘Versatility’ implies that the space should be customisable; whether or not there are cues in the space as to what it could (or should) be used for may vary from space to space. Some spaces may be functionally agnostic, and some may be functionally suggestive, but what is important is that they are flexible enough to be used for different things at different times and to suit changing needs. This may involve defining the purpose of a space to a certain extent; it should still be recognisable as being for a certain type of activity, but it should not be so tightly defined that you can’t modify it to meet changing needs. Regardless of how prescriptive these spaces are; they should always be ready to be activated by an individual or group. For example: A therapy room should be able to accommodate both individual and group therapy; A consult room that is normally used by just a patient and clinician should be able to accommodate the patients’ extended family if they happen to visit during the consultation time; And a communal lounge should be able to support both the patient who needs low stimulation and intimate conversations and the patient who needs high stimulation and lots of activities.



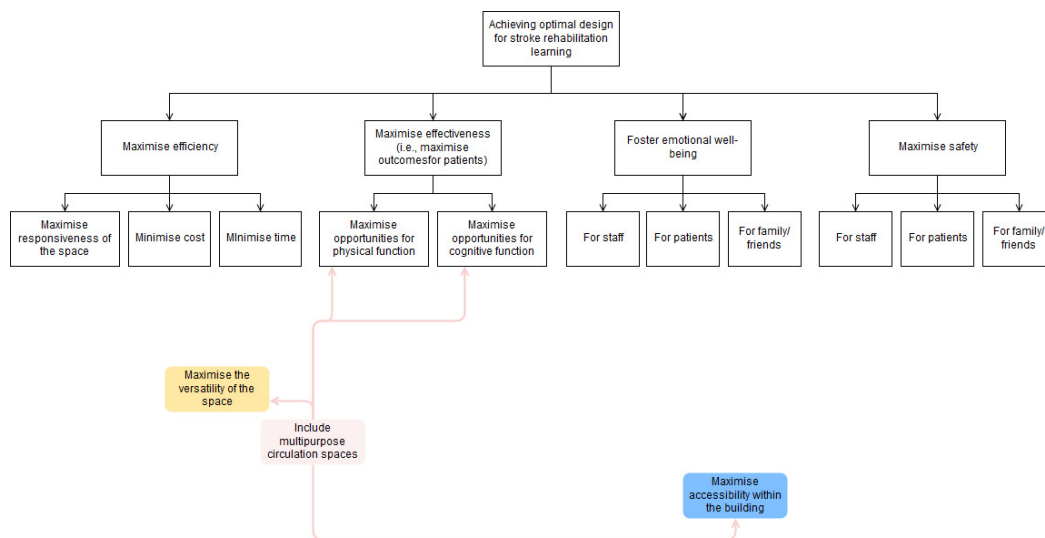
This objective is a means to:

- **Maximise the responsiveness of space** – A versatile space will be responsive to changing needs and requirements over the short-term
- **Minimise cost** – A versatile space can serve many functions, thereby decreasing the number of different types of spaces that may need to be included in the finished building.
- **Minimise time** – A versatile space can be quickly changed to suit needs, eliminating time wasted by staff, patients, and visitors in trying to find alternative, suitable spaces.
- **Maximise opportunities for practice of physical function and cognitive function** – A versatile space can be designed to suit changing clinical needs and to create opportunities for practicing physical and cognitive function.
- **Maximise safety for staff and patients and family/friends** – Having versatile patient rooms with moveable walls would allow patient beds and occupancy to be changed in response to infection control needs. Similarly, patient rooms could be adapted to suit patients with particular behavioural needs. E.g., single rooms could be created when needed, or multiple occupancy rooms could be created to house all patients with one particular strain of virus. Infection control obviously has implications for the safety of all people in the rehab facility.
- **Maximise personal control over the space** – Having a versatile space is a requirement for having a space that allows for personal control, and a space that

allows for personal control can be inherently more versatile. This is a bidirectional relationship. But note that having a versatile space does not automatically ensure that the space allows for personal control.

3.2.4 Means objective 4: Include multipurpose corridors/circulation spaces

The corridors, or circulation spaces, make up a large proportion of the overall floor space of a building and, in a rehabilitation facility, they naturally serve many functions to support clinical operations. Corridors are used as unofficial social spaces, hosting incidental and natural social interaction. They are used as storage spaces that allow equipment and wheelchairs to be stored close to patients (which thereby facilitates patients being independently mobile). They are used as unofficial therapy spaces, and may well be the first place where a patient walks by themselves unassisted. The naturally multipurpose or versatile characteristic of corridors should be encouraged in rehabilitation facility design so that these spaces can continue to serve many functions, whilst still providing a means for safe, efficient circulation and travel.



This objective is a means to:

- **Maximise opportunities for practice of physical function and cognitive function** – Multipurpose corridors may encourage patients to emerge from their rooms and engage in incidental practice of physical and cognitive functions.
- **Maximise the versatility of the space** – Since circulation spaces make up a large proportion of the floorplan, multipurpose corridors can therefore be an

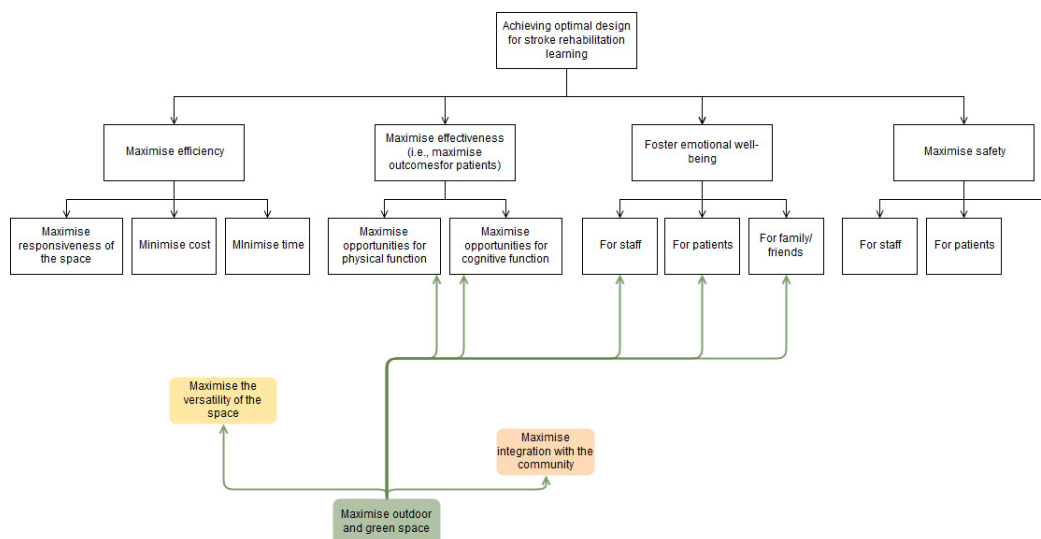
economic use of space and can go a long way to ensuring that the facility as a whole has some element of versatility.

- **Maximise accessibility within the building** – Well-designed circulation spaces work to link key services and promote access throughout the building. Well-designed multipurpose corridors should be wide enough to accommodate the many activities that naturally take place in these spaces so that the number of people and presence of equipment does not impact on safe transit throughout the facility. Note however that corridors should not be too long as this can become disorientating. Having some sort of natural light at the end of a corridor (rather than a door or dead end) can work to keep the space inviting.

3.2.5 Means objective 5: Maximise outdoor and green space

There is emerging evidence that nature, the outdoors, and green spaces are beneficial for brain recovery and emotional well-being. Patients, staff, and visitors should have easy access to these spaces in a rehabilitation facility. As well as providing access to nature, well-designed outdoor spaces can be incredibly versatile; they can be used by individuals or by large groups, and for many different types of activities.

Outdoor space can be incorporated into the design of the building to provide views of nature from patients' rooms (especially from their beds), therapy areas, and communal areas. However, privacy also needs to be accommodated for; the design should allow patients and staff to control the balance between views of the outdoors and privacy indoors.



This objective is a means to:

- **Maximise opportunities for practice of physical function and cognitive function** – Outdoor spaces provide more opportunities for practice of ‘real world’ physical function, and for social interaction. In addition, there is some evidence to suggest that nature itself is beneficial for brain repair.
- **Foster emotional well-being for staff and patients and family/friends** – Nature can be rejuvenating and relaxing, helping to combat stress for patients,

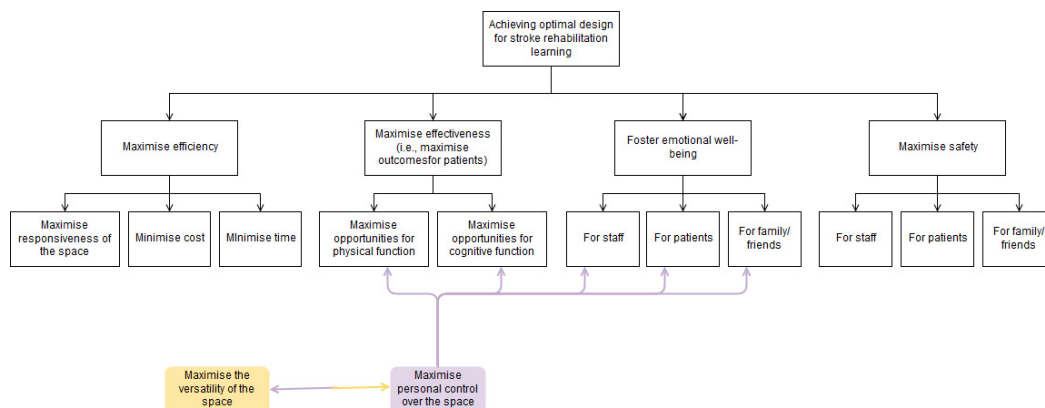
staff, and visitors.

- **Maximise the versatility of the space** – Well-designed outdoor spaces can be used for many different things and can meet many different needs.
- **Maximise integration with the community** – Outdoor spaces with public access can facilitate interaction with the community.

3.2.6 Means objective 6: Maximise personal control over the space

‘Maximising personal control over the space’ means that patients, staff, and visitors should be able to execute personal choices in regards to their environment. This encourages a feeling of agency and responsibility. The objective of ‘personal control’ is related to the objective of ‘maximising the versatility of space’, because a space that allows for personal control may have some inherent versatility, but these two objectives are distinct from each other because a space may be versatile without allowing for personal control over that versatility, and personal control can be executed by choosing between different types of spaces even if the individual spaces have no inherent versatility.

There are dichotomies of needs that exist in stroke rehabilitation that need to be accommodated. Relaxing and restorative spaces are needed to allow people to de-stress or contemplate, but patients may also need stimulating and energising spaces to create opportunities for practicing cognitive function and to combat boredom. Similarly, there needs to be private or intimate spaces (both aurally and visually private) so that patients can be alone by themselves or with loved ones, and there needs to be social or communal spaces that encourage social interaction and facilitate incidental peer-to-peer learning (which is emphasised in education settings). In addition, stroke can happen at any age, so it’s important that patients can create age-appropriate spaces. Maximising patient, staff, and visitor’s control over the space allows them to create the appropriate balance between these dichotomies and to change this balance from day to day or hour to hour. It also allows patients and visitors to introduce a level of normality, familiarity, or homeliness to their environment.



This objective is a means to:

- **Maximise opportunities for practice of physical function and cognitive function** – Having personal control allows patients, staff, and visitors to change the space to suit clinical needs. In addition, a sense of agency may be key to motivating patients to practice physical and cognitive function.
- **Foster emotional well-being for staff and patients and family/friends** – Having personal control allows patients, staff, and visitors to change the space to suit their emotional and well-being needs. In addition, having control introduces a sense of agency, which can be uplifting and empowering.
- **Maximise the versatility of the space** – A space that allows for personal control, i.e. that allows individuals to make their stamp on it and to change it to suit their needs, is inherently more versatile.

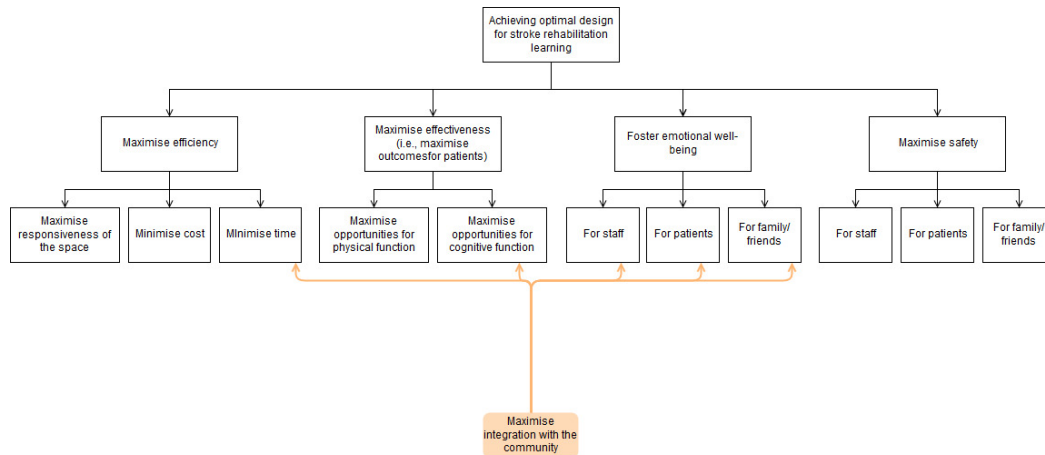
3.2.7 Means objective 7: Maximise integration with the community

A stroke rehabilitation building should maximise the facility's integration with the wider community. Integration in this sense refers to how the facility is situated in relation to the existing community, but also how it contributes to this community.

The building should be located in close proximity to associated health services, but more than that, its location should allow staff, patients, and visitors to easily travel to the building (e.g., easily accessible by car or public transport). An accessible location will encourage family and friends to visit, which may benefit the emotional well-being of patients and provide opportunities for social interaction and practicing cognitive function. The ease of the journey to and from the building is also important once a patient is discharged as they may be required to travel daily to attend therapy as an outpatient.

In addition, a rehabilitation facility that is integrated into the community can contribute to the neighbourhood and become 'more than just a hospital', providing benefit to staff, patients, visitors, and the general public. Including public spaces within the facility (e.g., cafs, gardens, even the hydrotherapy pool) will encourage people in the community to use these spaces. The street level of the building in particular should incorporate porous public space, and design consideration should be given to the identity of the building and how it contributes to the community.

As well as adding value to the local community, this integration will also benefit patients by signifying a level of de-institutionalisation, thereby 'normalising' the environment, and introducing ready-made communal or social spaces. Access to public spaces within the hospital will introduce a break in a patient's routine, combat boredom, and encourage social interaction. In addition, having access to 'normal' facilities such as cafs provides opportunities for therapeutic practice of skills required in everyday life; an occupational therapist may work with a patient to go to the caf and order a coffee and thereby practice the necessary cognitive functions.



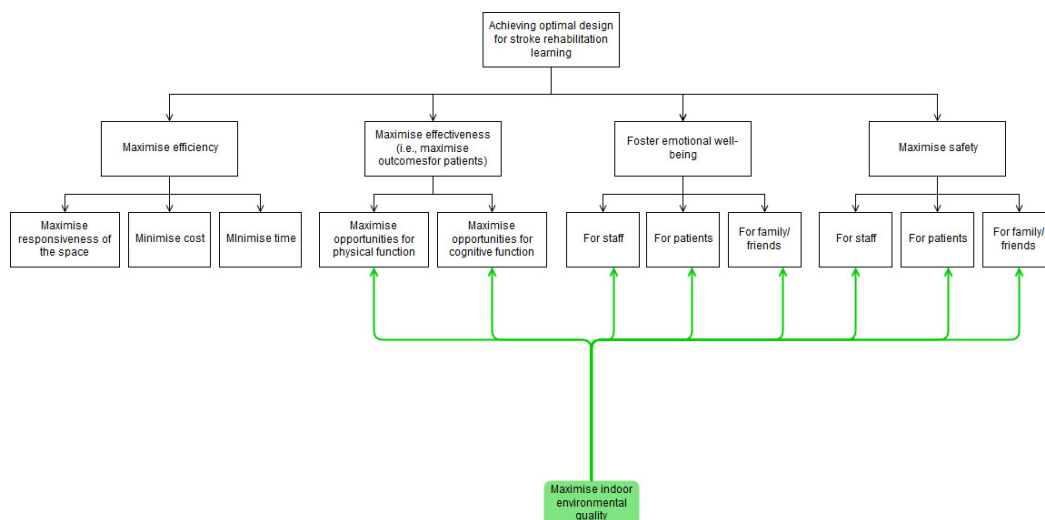
This objective is a means to:

- **Minimise time** – Integration in the community may minimise travel time for staff, patients, and visitors to get to the facility. It may also minimise the time to transport patients from associated health services.
- **Maximise opportunities for practice of cognitive function** – Public spaces provide opportunities for both incidental and programmed practice of cognitive functions.
- **Foster emotional well-being for staff and patients and family/friends** – Being integrated into the community introduces some level of normalcy for patients, i.e., allows them to observe or participate in some aspects of normal life. This also applies to staff and visitors.

3.2.8 Means objective 8: Maximise indoor environmental quality

As in all buildings, the design should ensure a good quality indoor environment. This includes air quality, light levels (including access to natural light), ceiling heights, sound levels, views of the outdoors, and orientation to the sun. In addition to these general requirements, the indoor environment should be designed to suit the specific needs of patients with brain injury. For example, people who have had a brain injury may experience standard indoor lighting as very harsh. Sleep is important for stroke rehabilitation, so appropriate lighting and noise levels at night is also essential.

Indoor environmental quality should be maximised in all areas of the facility including the patients' rooms, staff areas, therapy areas, communal spaces, and corridors/circulation spaces.



This objective is a means to:

- **Maximise opportunities for practice of physical function and cognitive function** – Indoor environmental quality affects patients' sleep and so may impact their clinical outcomes. Noise levels during therapy are also important so that the patient and staff can effectively communicate and concentrate
- **Foster emotional well-being for staff and patients and family/friends** – A good indoor environment is integral to creating a pleasant aesthetic and a sense

of emotional well-being.

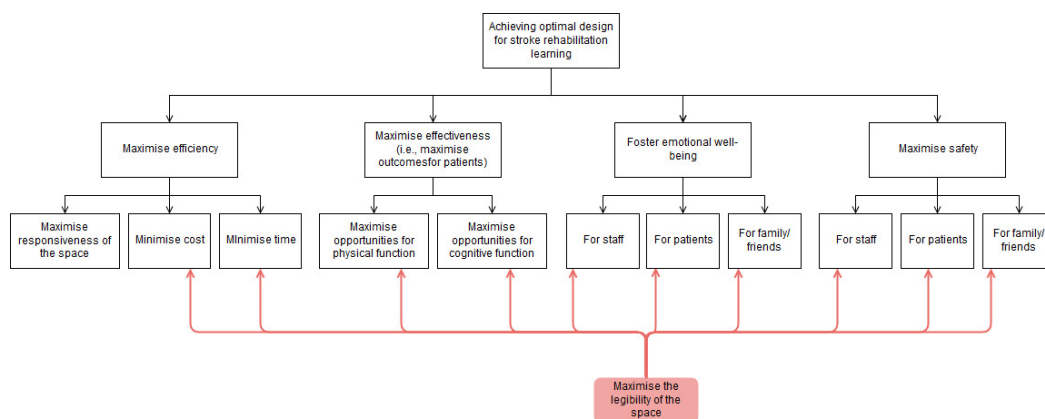
- **Maximise safety for staff and patients and family/friends** – Air quality is of obvious importance in terms of infection control, and light and sound levels are important for staff attention and concentration (reduce medical errors) and for general occupational health and safety.

3.2.9 Means objective 9: Maximise the legibility of the space

A ‘legible’ space is easy to navigate and understand. Legibility of space, or wayfinding, is not just about signage although that is important it is also about being able to predict, or anticipate how a space is laid out. Environmental cues (e.g., staircases and reception desks) can help people understand where to go and what different areas are for. Information provision is another key component of a legible space; patients and visitors need to be provided with information prior to their visit and upon arrival to facilitate their understanding of the space.

The aim is for a stroke rehabilitation facility to have intuitive wayfinding, but, importantly, it must be intuitive for patients who have had a stroke and who may have cognitive impairments not just intuitive to the healthy population. Consideration should also be given to people with low literacy, people who do not speak English, and people with visual or other sensory impairments.

The entry to the rehabilitation facility can be a key component in ensuring the legibility of the entire facility. The arrival or entrance to a building forms the first impression of the building and is therefore very important and memorable. The entry should provide a clear demarcation that introduces the rehabilitation space as a different type of space, it should also create a sense of safety, and it should clearly indicate what different spaces are for.



This objective is a means to:

- **Minimise cost and Minimise time** – Patients and visitors who feel disorientated or lost will ask staff for directions, which impacts on staff time (and therefore costs). Disorientated patients may take longer to get to therapy and so therefore may leave therapists waiting (again impacting on staff time and costs).
- **Maximise opportunities for practice of physical function and cognitive function** – Being oriented enough to move about yourself creates opportunities for practice of physical and cognitive function, and it allows people to access existing opportunities for physical and cognitive function. Legible spaces also mean less time finding your way and getting lost, therefore leaving more time for incidental and deliberate practice.
- **Foster emotional well-being for staff and patients and family/friends** – Good wayfinding can reduce stress in a foreign environment and is especially important for people have an impairment or who are experiencing fatigue. Getting lost or disorientated and having to walk further can sap energy and impact on pain levels.
- **Maximise safety for staff and patients and family/friends** – Legible spaces can help patients and visitors orient themselves, which is important for emergency evacuation.

3.2.10 Means objective 10: Maximise accessibility within the building

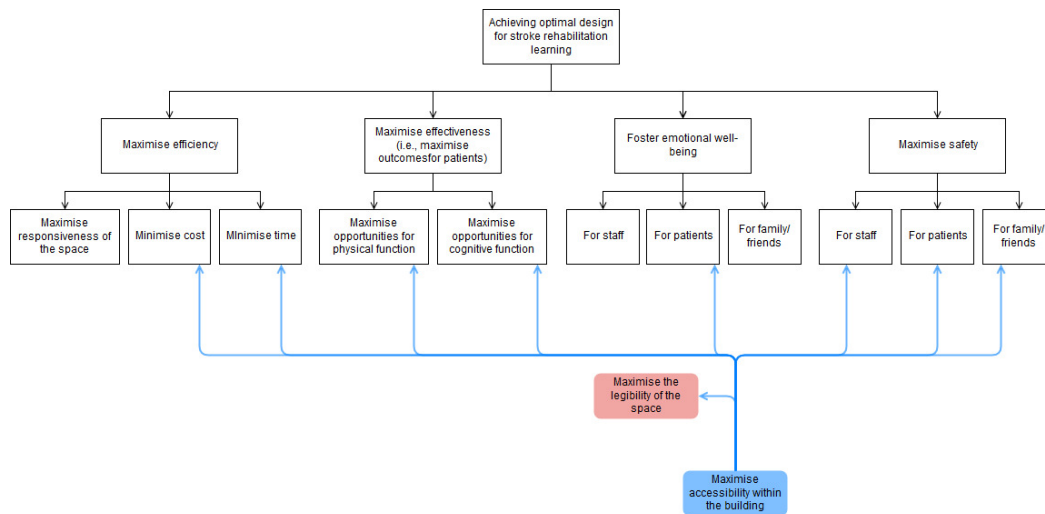
A rehabilitation building should be designed so that all staff, patients, and visitors can independently access the necessary parts of the facility in a timely fashion. There are a number of considerations that need to be taken into account in order to make a rehab building accessible including colocation of facilities, journey time within the building, access to services, and disability access.

Good accessibility should minimise the amount of time that patients and staff have to spend travelling within the building. In some rehab facilities, staff can spend a lot of time walking between services or between patient rooms especially in facilities in which there is only one patient per room. It is also not unheard of for patients to have to travel long distances between the ward and therapy (as an extreme example, there is a stroke unit in Darwin at which the patients need to get on a bus to go to the rehab gym). Accessibility can be improved by removing physical barriers wherever possible, including avoiding changing levels/floors, and colocating key rehabilitation services such as the gym, occupational therapy, and other allied health services.

Obviously designing for colocation requires a weighing of priorities; it's impossible to have all sections of the facility next to each other. Time should be spent in the design phase to map out usage patterns and travel times, and to discover the 'core' spaces and how they interact. This information can then be used to ensure that the facility's layout supports the service of care. Patients should be able to independently access spaces that facilitate social interaction and incidental or planned cognitive and physical practice. Patient should not need to rely on staff in order to gain access to outdoor spaces, communal spaces, public on-site services (e.g. cafs), and therapy spaces. These spaces should be in a central location and circulation between these spaces and the wards should be designed to encourage patients to access these spaces independently (e.g., wall rails, minimise distances, no locked doors, etc.). Importantly, entry to these spaces should not be limited to the 9-5 working day. Rather than being organised around staff working hours, services such as cafs need to remain open and operational at times that coincide with the facility's visiting hours (e.g., evenings and weekends), otherwise they become inaccessible at the times at which patients and visitors would most benefit from them.

Importantly, it is essential that people with a disability can independently access all areas of the facility this includes people who use a wheelchair or other mobility aids, and people who have a visual or other sensory impairment.

The concept of accessibility also links to visual access within a building (i.e., sightlines) which is important for legibility of space and patient safety (see ‘Maximise the legibility of the space’ and ‘Maximise sightlines’).



This objective is a means to:

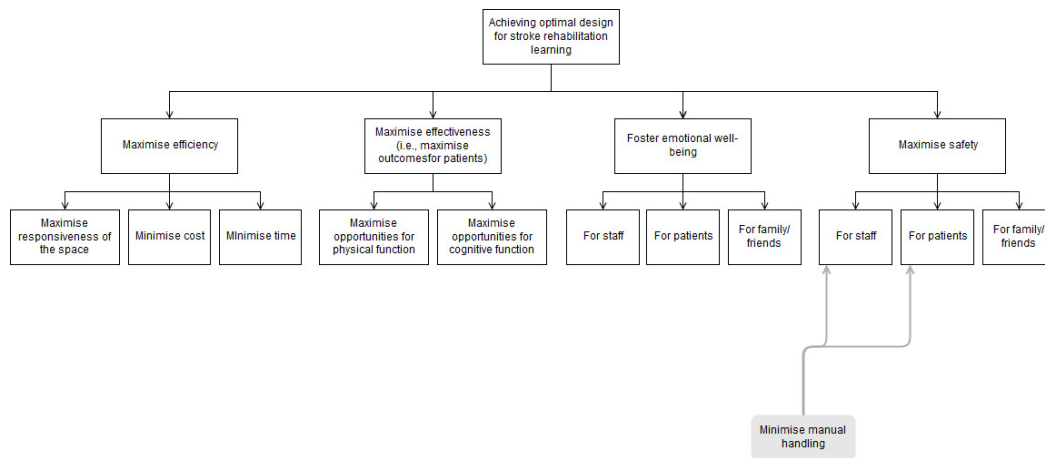
- Minimise cost and Minimise time** – It is detrimental to both time and cost if staff have to travel long distances between patient rooms, porter patients to therapy, or wait for patients to get to therapy. Large wards with all majority single patient rooms may need to hire more nurses in order to ensure appropriate observation of patients, which is costly for the facility.
- Maximise opportunities for practice of physical function and cognitive function** – Therapy sessions often only take up 2-3 hours of the day, 5 days per week and patients are often inactive and alone when they are not in therapy. Having independent access to more spaces in the rehabilitation facility may give patients more opportunity to engage in incidental practice, or self-motivated deliberate practice. In addition, therapy sessions (e.g., with the physiotherapist, occupational therapist, or speech therapist) are often scheduled for consecutive,

short periods during the day, and travelling long distances between these sessions may therefore cut into the patient's therapy time and so decrease their opportunities for deliberate practice of physical or cognitive functions. It could be argued that having to travel some distance to therapy may provide patients with an opportunity for incidental physical practice en route, but if the distance is too large then patients will need to be portered to therapy and so any possibility of incidental practice is removed.

- **Foster emotional well-being for patients** – Arduous travel times within the building may make patients feel more incapable and reliant as they may need to depend more on staff to get from a to b. Being able to get to rehab by themselves may help patients to feel more agency and independence.
- **Maximise safety for staff and patients and family/friends** – Accessibility within a building is obviously important for emergency evacuation, and good sightlines may improve patient safety. However, there may also be a negative relationship between accessibility and safety; unhindered patient and visitor access within the rehabilitation facility may increase the risk of fall or injury for patients, and it may also make the facility more vulnerable to theft and other petty crimes. The benefits and risks of accessibility must be weighed during the design process. Many of the risks associated with accessibility may be alleviated by ensuring that the design facilitates good sightlines and integration with the community (both of which increase human observation throughout the space).
- **Maximise the legibility of the space** – People need to be able to access areas in order to familiarise themselves with those spaces. Accessible spaces with obvious, tangible functions can be easier to understand and navigate.

3.2.11 Means objective 11: Minimise manual handling

Stroke rehabilitation facilities should be designed to minimise the amount of manual handling that staff need to do in regards to lifting a moving patients and equipment by hand. This is a fundamental occupational health and safety issue. Hoists, railings, and other assistive technologies should be incorporated into the design; storage spaces for equipment should be easily accessible (i.e., at appropriate heights and close to patient areas); and distances between key facilities and services (e.g., bed and toilet) should be minimised. In addition, the design should be flexible enough to adapt as new manual handling solutions are developed.



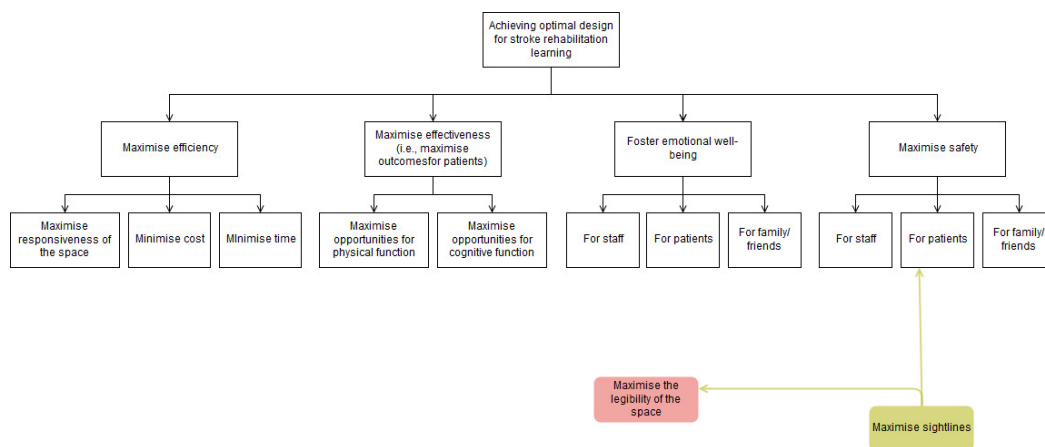
This objective is a means to:

- **Maximise safety for staff and patients** – Minimised manual handling will help to improve the safety for staff and patients.

3.2.12 Means objective 12: Maximise sightlines

The design of stroke rehabilitation facilities should allow people to easily see across key spaces (i.e., the facility should have good sightlines). Having good sightlines between e.g. the nurses station and patients' room allows staff to readily observe a number of patients simultaneously, which may reduce falls risk. In addition, having good sightlines from the entrance to the rest of the building, or between key locations within the building, can help patients and visitors orient themselves in space. Being able to see your destination, or your starting point, makes the space more legible and predictable.

However, the objective of maximising sightlines needs to be weighed up against the need for private spaces. This conflict could be addressed by ensuring that patients, staff, and visitors can exercise personal control over the space.

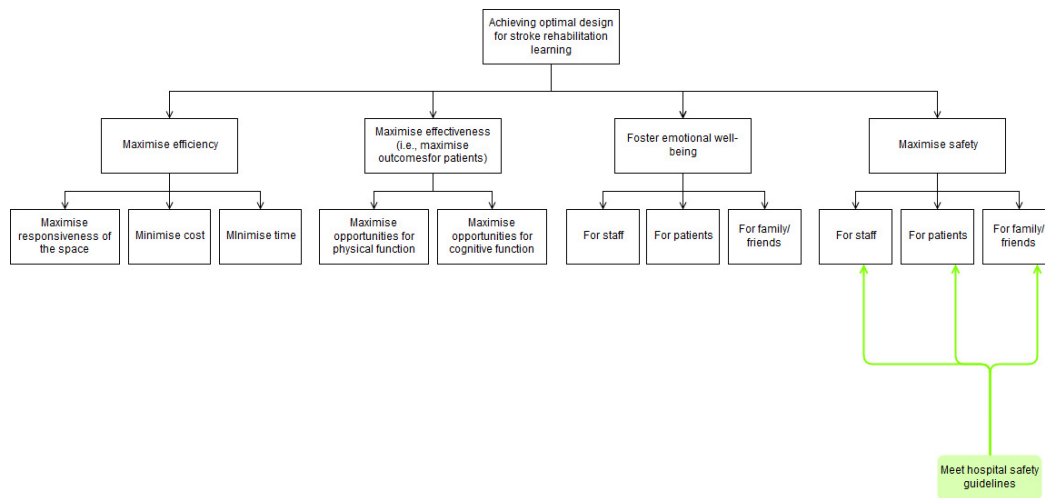


This objective is a means to:

- **Maximise safety for patients** – Good sightlines allow staff observation of patients, which may reduce falls-risk.
- **Maximise the legibility of the space** – Good sightlines allow people to see how they are positioned within a larger space and so help to improve orientation and legibility of the space.

3.2.13 Means objective 13: Meet building safety guidelines

Stroke rehabilitation facilities should meet or exceed the building safety requirements or guidelines as laid down by the appropriate governing agency. These guidelines should stipulate, among other things, fire safety measures (e.g., number and placement of fire extinguishers, fire exit signage, etc.), balcony railing height, security cameras and monitoring, duress systems, etc. Although much of these guidelines may be the same as for any public building, some alterations may need to be made for a stroke rehabilitation setting (e.g., extra safe holding space for people in wheelchairs in the case of fire).



This objective is a means to:

- **Maximise safety for staff and patients and family/friends** – Standard building safety guidelines are required to insure the minimum safety standards are met for a public building.

3.3 Measurement methods or tools to evaluate the objectives

After the network of means objectives had been discussed and refined, the workshop attendees turned their attention back to the hierarchy of fundamental objectives. The attendees considered each of the fundamental objectives in turn and brainstormed possible measurement methods, tools, or approaches that could be used in an (hypothetical) existing rehabilitation facility to evaluate each of these fundamental objectives. During this group discussion, the suggested measurement tools were listed on the whiteboard (see Figure 4).

The attendees were encouraged to draw on their experience from their respective disciplines in the hope that a cross-disciplinary evaluation program could be developed. If an appropriate measurement tool could not be identified for a particular fundamental objective, attendees were encouraged to consider whether there may be a measurement tool that could be appropriate to evaluating a relevant subsidiary means objective instead.

After Workshop 2, the whiteboard notes in Figure 4 and the audio-recordings of the group discussion were used to create a list of the suggested measurement tools. These measurement tools are described in sections 3.3.1 to 3.3.5 and are mapped on to the hierarchy in Figure 5. This list of measurement tools represents the results from a brainstorming session and will need to be refined before being applied in practice.

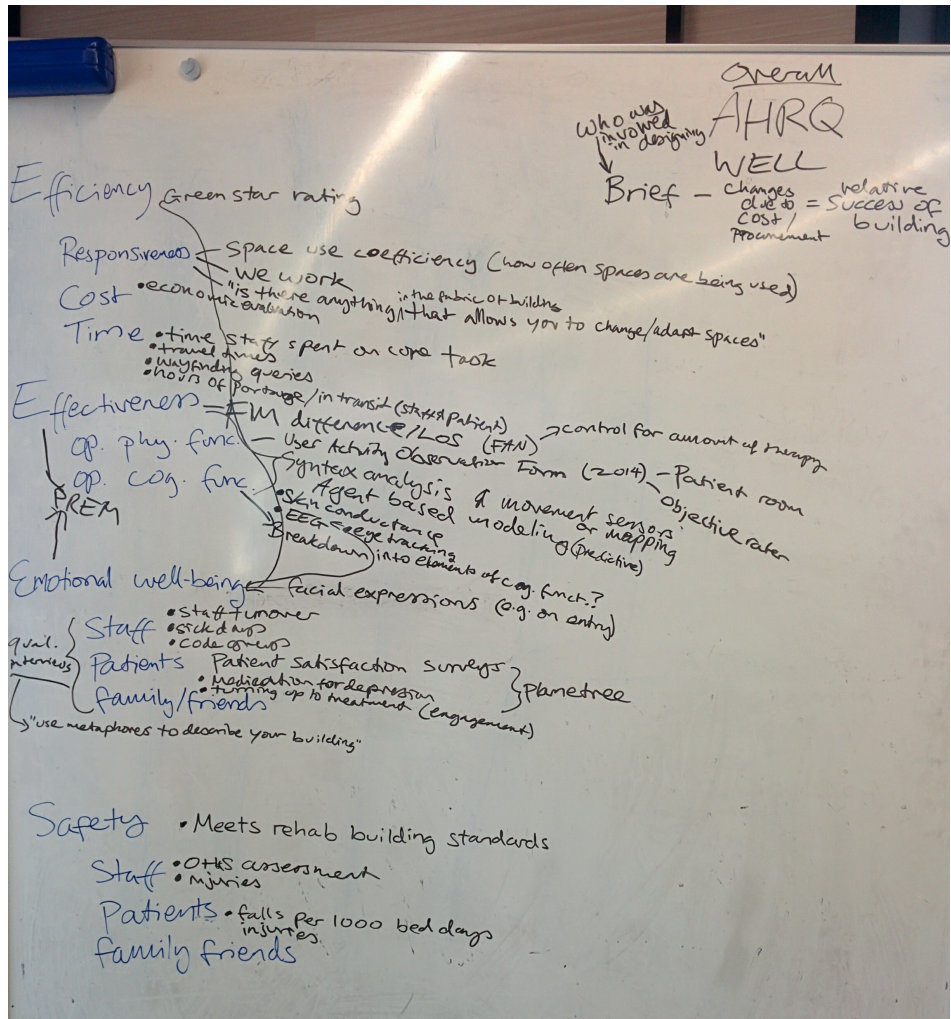


Figure 4: Whiteboard notes taken during the brainstorming session in which measurement methods and/or tools were identified for evaluating each of the objectives.

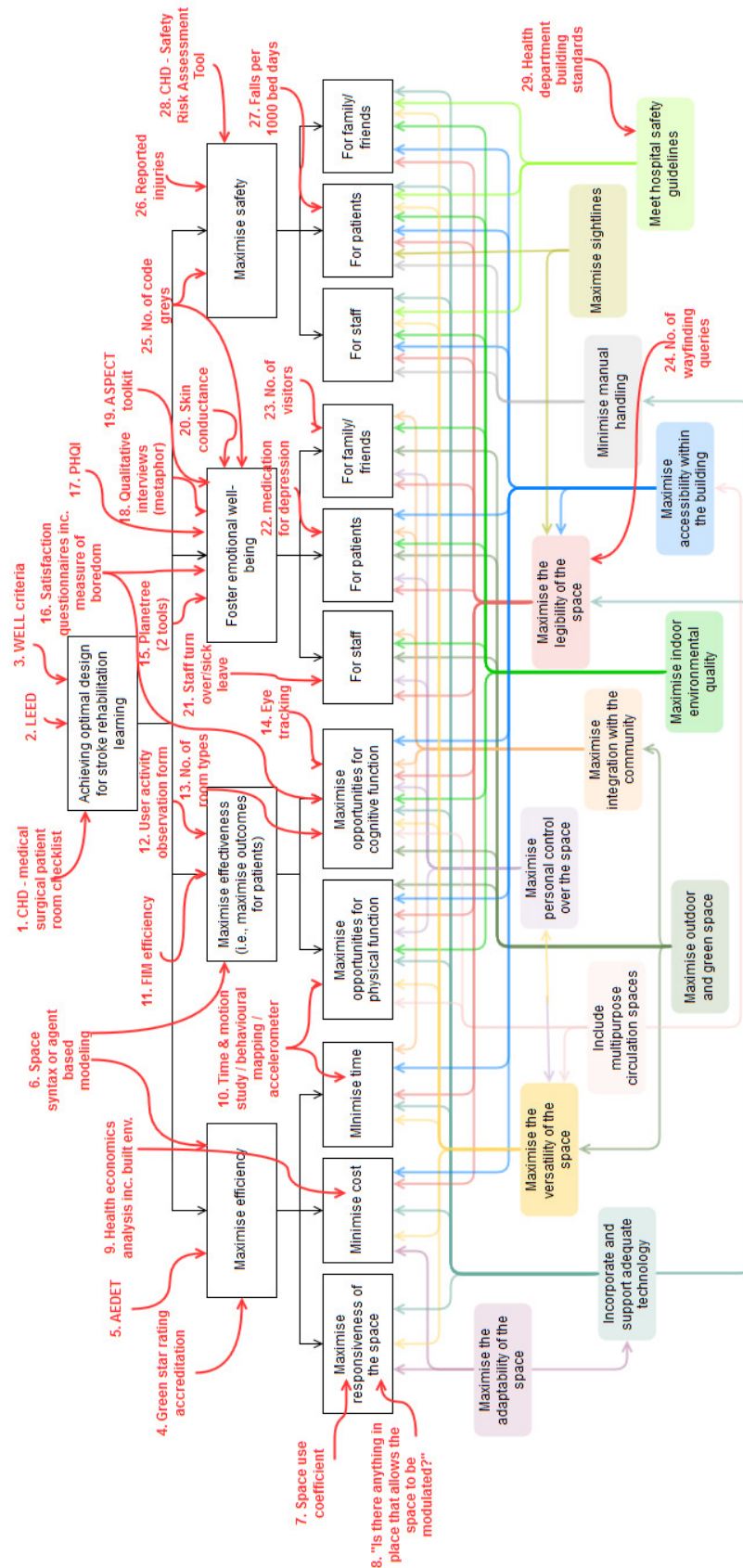


Figure 5: The brainstormed list of measurement tools or approaches (in red) mapped onto the hierarchy and network of objectives. Each measurement tool or approach is defined in sections 3.3.1 to 3.3.5 in the order in which they are numbered in this figure.

3.3.1 Measuring the built environment overall

There were a few measurement tools mentioned that could provide an overall assessment of the built environment. None of these tools are specific to rehab or healthcare, but sections of them may be suitable for adaptation.

In addition to the options listed below, attendees also noted that the difference between the design intent and the design as built may give an indication of the overall success of the building. A theoretically ‘perfect’ design will experience changes as a result of budget restrictions, difficulties in procurement, and project management which will result in alterations to the design intent in the final build. There is no guarantee that what is actually intended is what ends up being built. This concept can be expressed by the following formula:

$$\text{Design intent} - \text{Unwanted design changes} = \text{Relative success of the building}$$

Unfortunately, the design changes that occur as a result of this process are not really captured anywhere in a way that they can be accessed for evaluation or research purposes.

What is more, the success of the whole project (from design intent to final build) may be dependent on who is involved in the design process – i.e., were clinicians and consumers consulted at each stage of the project? Having this documented would help with the evaluation of the final design.

1. The Centre of Healthcare Design’s (CHD) Medical Surgical Patient Room Checklist

This checklist is designed to be completed by an assessor (who can be anyone – no need for training) at one time-point whilst on site at the hospital. The checklist is organised by 23 evidence-based design goals which sit within four overarching categories: Patient safety; Worker safety and effectiveness; Quality of care and patient experience; and Organisational performance. This tool allows for customisation; different weights, or priorities, can be applied to each of the evidence-based design goals before completing the checklist. The checklist can be downloaded for free from the CHD website (click [here](#) to go to the website).

- Pros: Relatively evidence based; Relatively customisable; Developed to be an industry standard; The four overarching categories are similar to the fundamental objectives in our hierarchy; Easy to use and complete (excel doc); Free.
- Cons: Intended for use during the design phase (but can also be used post-occupancy); Designed to assess the patient room only (not the whole building); Answers depend on the opinion of the assessor/rater; Does not include some objectives specific to rehab; Last updated in 2015.

2. Leadership in Energy and Environmental design(LEED)

LEED is an international rating and accreditation system designed to measure how 'green' a building is. LEED accreditation takes into account the overall impact of the building on the people inside it and the general community, so may apply to elements of our hierarchy such as efficiency, well-being, and safety. For example, one of the criteria concerns the location and transport of the building and so may be relevant to our means objective to 'maximise integration with the community', and another criteria concerns the 'indoor environmental quality'. There are a few LEED accreditation options, the 'Building Design & Construction' (BD+C) accreditation is the option that would apply to a Healthcare building. A free reference guide for this can be found [here](#). This BD+C reference guide has eight categories within it that correspond to what the LEED rater will assess: Location and transportation; Sustainable sites (i.e. the environment surrounding the building); Water efficiency; Energy and atmosphere (i.e. renewable energy); Materials and resources; Indoor environmental quality; Innovative building features; and any regional priorities specific to the location of the building. Follow the link to the reference guide (above) for more details.

- Pros: Evidence based; Developed to be an industry standard; Some of the sections measure things that are relevant to our fundamental or means objectives.
- Cons: Intended for use during the design phase; The project must meet particular [requirements](#) in order to be eligible for the program; Not customisable; Not free; Designed to be completed by an external LEED assessor; Does not take users' needs and expectations into account; Not healthcare specific.

3. WELL criteria from the International WELL Building Institute

WELL is an international rating and accreditation system that is part of the general well-being movement. The WELL criteria are designed to measure how well a building helps people "work, live, perform and feel their best". A guide to the WELL building standard can be downloaded [here](#). The guide covers the eight features which are assessed as part of the WELL accreditation: Air; Water; Nourishment; Light; Fitness; Comfort; Mind; and Innovation. Each of these features have many detailed components within them (105 in total). The WELL criteria was originally created for office and commercial buildings, but an addendum has since been added that is designed to be applicable for educational facilities (can be download [here](#)). This addendum lists some new considerations that are specific to an education context and it also lists all of the 105 core components of the WELL criteria and provides weightings for each of them to indicate how important they are in an education context. A similar addendum will apparently be developed for healthcare facilities in the future.

- Pros: Evidence based; Developed to be an industry standard; Some of the sections (of both the standard criteria and the educational facilities addendum) measure things that are relevant to our fundamental or means objectives.
- Cons: Intended for use during the design phase; Not customisable; Not free; Designed to be completed by an external WELL assessor; Not healthcare specific.

3.3.2 Measuring efficiency in the built environment

4. Green star rating accreditation

The Green Star rating and accreditation system is run by [The Green Buildings Council Australia](#). The Green Star rating tools focus on assessing the environmental sustainability of a building and, although this is not one of our objectives, it may be relevant because it can impact on the emotional well-being of the building's inhabitants and the wider community, and on the general efficiency of the building including costs. There are Green Star rating tools for the design and construction of a building, as well as for the ongoing performance of a building.

- Pros: Evidence based; International industry standard; Some of the tools may measure things that are relevant to our fundamental or means objectives.
- Cons: Not customisable; Not free; Designed to be completed by an external Green Buildings Council Australia assessor; Does not take users' needs and expectations into account; Not healthcare specific.

5. AEDET Evolution

The Achieving Excellence Design Evaluation Toolkit (AEDET) was developed by the University of Sheffield and the NHS specifically to evaluate the design quality of healthcare buildings. AEDET Evolution is the most recent iteration of the tool. Like the Medical Patient Room Checklist developed by the CHD, AEDET is a checklist that is designed to be completed by anyone at one time-point whilst on site at the hospital. It can be downloaded [here](#).

AEDET encompasses three key areas (impact, build quality, and functionality), but its content is most suited to measuring the efficiency objective in our hierarchy. The checklist has an evidence 'layer' which allows you to see what research is backing up each question in the checklist.

The NHS now recommends using the [Design Quality Indicator \(DQI\)](#) instead of AEDET. However, while the AEDET is a simple checklist and it's free, the DQI is a 'facilitated process' of structured workshops that are designed to be used across a

project's lifecycle and that must be purchased through the Construction Industry Council.

There is also an optional plug-in to the AEDET that is specific to patient and staff environments in healthcare. This plug-in – A staff and patient environment calibration toolkit (ASPECT) – is described in more detail in Section 3.3.4 below.

- Pros: Relatively evidence based; Relatively customisable; Developed to be an industry standard; Elements map on well to the efficiency objective in our hierarchy; Easy to use and complete (excel doc); Free.
- Cons: Answers depend on the opinion of the assessor/rater; Does not include objectives specific to rehab; Last updated in 2008.

6. Space syntax or Agent based modelling

Space syntax analysis measures the relative connectivity of a space to all of the other spaces around it. The connectivity of a space provides a 'heat map' of how people may move in the space which can give a strong indication, but not a guarantee, of how a space will be or is used by people. Space syntax analysis was developed at [the Bartlett School of Architecture](#) as a tool to help in planning towns and cities, but is now also used for designing buildings. It can help you to determine e.g., where to put a communal or break out space, or where to put spaces that encourage physical activity and social interaction.

To perform Space syntax analysis you divide the floorplan of your building into equal squares (imagine laying a grid over it – e.g., $1 \times 1m^2$) and then use software to analyse the connectivity of each square to every other square in the grid. This 'connectivity' can be measured as the angle, distance, or line of sight between the squares on the grid (i.e., you can change your metric of interest within the software). You can also change the parameters in the software to reflect a) someone who is familiar with the environment or b) someone who is new to the environment or c) someone who has mobility impairment.

However, there are limitations to this form of analysis. Firstly, space syntax analysis is easily fooled because assumes that every square is equal and does not

automatically take the contents of the square into account. This means that if one square of space contains a major attraction or dominant feature, such as a caf, then the result of the space syntax analysis will not take into account the anomalies that this will create in terms of the connectivity of the space (i.e., it will not account for the fact that people will flock to the caf). It is possible to mitigate this by programming some of these exceptions into the software. Secondly, space syntax analysis gives a theoretical output, which may not reflect what might actually happen in the space in real life. The results of space syntax analysis can be made more ‘true to life’ by combining them with data from an existing building. To analyse how people use an existing building, one could define which spaces provide opportunities for ‘cognitive practice’ and which provide opportunities for ‘physical practice’ in an existing building and then do a combination of theoretical space syntax analysis and behavioural mapping in these spaces. Alternatively, behavioural mapping data could be replaced by data from room sensors in the finished building which could tell you how many people are in the room at any one time.

Agent Based Modelling is, like Space Syntax Analysis, a type of computer model. Agent Based Modelling simulates the actions of individuals in order to assess how each individual impacts the system as a whole. Unlike Space Syntax Analysis, Agent Based Modelling does not take into account the physical space that these individuals are in, but it does (presumably?) provide more opportunity to define each of the individuals in the space. [AnyLogic](#) is an example of software used for Agent Based Modelling.

7. Space use coefficient

Space Use Coefficient (also called Space Occupancy Coefficient) is simply the number of people who use a room or space over a given period of time. By counting the number of people in a room, or by using sensors, you can track whether rooms are being used which could give you an indication of the versatility of a room.

‘[We work](#)’ is a commercial entity who have come up with a range of tools that measure the adequateness of different spaces for either particular use or for general use. These tools have been developed for corporate spaces, but they could possibly be adapted for healthcare spaces. In general, the tools measure occupancy and then use

machine learning to determine whether the room is actually being used in the way that it was projected to be used.

8. Rater assessed single question

Determining the responsiveness of a space could be as simple as asking a single question, such as: "Does this space have more than one purpose?" or Is there anything in place that allows you to modulate this space? These questions could be answered by staff, patients, or an independent rater and they could be applied to private spaces, communal spaces, and circulation spaces.

9. Health economics analysis

Health economics usually ignores the built environment, but a complete Health Economics Analysis – one that incorporates the physical building – would need to meld the costs of the built environment with the usual components of a health economics analysis such as the patient outcomes and related medical/clinical economics. This kind of complete Health Economics Analysis would be the most comprehensive way of evaluating the efficiency and relative effectiveness of a rehabilitation facility. This analysis would need to incorporate (amongst other things) the initial building costs, as well as ongoing costs of the building, costs to the patient, government, corporations, and the costs to the community incurred as a result of the building. This analysis could take a personal, societal, or organisational perspective. This could be a future PhD student project.

10. Time and motion study / Behavioural Mapping / Accelerometer

We know that it is more efficient for staff to maximise the amount of time they spend on their actual specialisation (i.e., doing what they trained for). For example, a nurse's job description should include 'non-essential core tasks such as socialising with patients, but we do not want nurses to have to spend time escorting patients to a car park in an obscure location. A time and motion study could give information about how efficient the building is in terms of minimising time spent on non-core tasks, and it could also give an indication of how much physical activity patients are doing (related to the effectiveness of the building). A time and motion study could be conducted in the form of Behavioural Mapping and could also incorporate accelerometer use to more

accurately measure the number of steps completed by staff, and the amount of 'up time' for patients. This type of study could provide information about e.g.: how much time staff spend on core tasks, how much time they spend travelling within the building, how much time patients spend in therapy, how much time patients spend active, and how much time patients spend in transit with porters.

Note however that a time and motion study does not automatically incorporate a measure of the built environment, and so it may be most useful when combined with another tool such as Space Syntax Analysis or Agent Based Modelling.

3.3.3 Measuring effectiveness in the built environment

A note about cognitive function

Do we need to consider the various components of cognition in order to properly understand how the built environment should respond? Components of cognitive function may include: memory, planning, language, visuospatial. Additional useful tools may become apparent once cognitive function is broken down into these components.

11. FIM efficiency

The Functional Independence Measure (FIM) is a standard tool used in stroke rehabilitation units to measure the functional abilities of a patient. The FIM is completed by a clinician who assesses the patient's level of independence for a set of motor and cognitive tasks. The motor subscale includes: Eating; Grooming; Bathing; Dressing upper body; Dressing lower body; Toileting; Bladder management; Bowel management; Transfers between bed/chair/wheelchair; Transfers to toilet; Transfers to bath/shower; Walk/wheelchair; and Stairs. The cognition subscale includes: Comprehension; Expression; Social interaction; Problem solving; and Memory.

The FIM is usually taken at admission and discharge (at minimum), and a FIM efficiency score can be calculated by dividing the change in FIM score by the patient's length of stay. FIM efficiency therefore gives an indication of the patient's rate of improvement while in rehab. A rehab unit's funding may be linked to their FIM efficiency results (which is one of the reasons why it is so routinely measured). Note however that when presenting FIM efficiency scores, information should also be given about the severity of the stroke and the amount of therapy that the patient actually received whilst in rehab.

FI is a trademark of the Uniform Data System for Medical Rehabilitation, a division of UB Foundation Activities Incorporated. Australasian Rehabilitation Outcomes Centre holds the territory license for the use of the FI instrument in Australia.

12. User Activity Observation Form

The Assessment Tool for Occupation and Social Engagement (Morgan-Brown & Chard, 2014) is designed to assess the usability of the space. The tool was developed for an aged care setting, but could possibly be applied in a rehabilitation facility. Like behavioural mapping, this tool is completed by an independent rater who collects the data via observation. The tool is included in the Morgan-Brown & Chard (2014) publication.

13. Count of the number of different types of rooms in the building

A simple count of the number of different types of rooms or spaces available to the patient may give an indication of how many opportunities for cognitive stimulation the building provides. However, a measure such as this would need to be combined with information about how these rooms connected with each other and whether they allow accessed.

14. Eye tracking

Eye tracking can be predictive of the novelty response, so if someone is not tracking anything with their eyes then they are likely to be bored or have impaired memory. Changes in eye tracking could indicate whether people are interacting with other people/activities, and so could be an indication of opportunities for cognitive function, changes in emotional well-being, and/or levels of boredom. Eye tracking technology can be included in VR technology which can allow researchers to work out which aspects of an environment are engaging and novel for people.

3.3.4 Measuring emotional well-being in the built environment

15. Planetree

The Planetree organisation was developed in the 1970s as a response to the lack of patient or consumer involvement in healthcare. Planetree advocate for patient-centred care and place great importance on healthcare design which they think should support patient's "personalized choice, dignity, and control" (see the [Planetree website](#)). They have developed a number of measures of how patient-centred the built environment is. Two that may be relevant to this project are: 1) the 'Patient-Directed Visitation Quality Check', which was developed to assess how patient-centred a hospital's approach to visiting is, and can be downloaded [here](#); and 2) the 'Person-Centered Environment Audit Tool for Hospitals', which can be downloaded [here](#).

16. Satisfaction or experience questionnaires (for staff, patients, and family/friends)

Most healthcare facilities routinely collect satisfaction or experience surveys from patients and visitors, and sometimes staff. Data from these surveys would be easy to collect, and could give an indication of the patients' experience (and perhaps also the efficiency of the facility).

17. Perceived Hospital Environment Quality Indicators (PHEQI)

This self-reported questionnaire was developed by Andrade et al. (2012) to assess patients' perceptions of the the environment of the hospital. This scale assesses the quality of both the physical and social environment of the hospital. The tool is included in the Andrade et al. (2012) publication.

18. Qualitative interviews (metaphor)

Some of the most important reactions to a space may be about the 'feel' or 'atmosphere' of a space, rather than being about anything quantifiable. Most rehabilitation buildings feel like a hospital, but should they? The 'personality' or 'vibe' of a building is important. The 'quality' of a space could be measured by qualitative means like ethnographic means, e.g. photo elicitation. Some of the qualitative or ethnographic methods used to try and tap into the feel of a space could include: video

diaries; photo elicitation; or interviews (which could be guided, walking interviews). One interview approach could be to encourage the interviewees to describe their environment in metaphor. For example, asking a staff member, "can you tell me what this space feels like to you?" often naturally leads to them giving an answer in metaphor, e.g.: "it feels like a rabbit warren", or "it feels like a prison". Perhaps metaphor is a good shortcut to understanding the 'vibe' of the building as it can provide a mental image of how someone 'feels' about the building.

19. ASPECT

A staff and patient environment calibration toolkit (ASPECT) was developed by the University of Sheffield and the NHS specifically assess design of staff and patient environments in healthcare buildings. ASPECT is an optional plug-in to the AEDET Evolution tool (see Section 3.3.2). ASPECT is a checklist that is designed to be completed by anyone at one time-point whilst on site at the hospital. It can be downloaded [here](#).

AEDET encompasses eight domains: 1. Privacy, company & dignity 2. Views 3. Nature & outdoors 4. Comfort & control 5. Legibility of place 6. Interior appearance 7. Facilities for patients 8. Facilities for staff . The checklist has an evidence 'layer' which allows you to see what research is backing up each question in the checklist.

The NHS now recommends using the [Design Quality Indicator \(DQI\)](#) instead of AEDET and ASPECT. However, while AEDET and ASPECT a simple, free checklists, the DQI is a 'facilitated process' of structured workshops that are designed to be used across a project's lifecycle and that must be purchased through the Construction Industry Council.

- Pros: Relatively evidence based; Relatively customisable; Developed to be an industry standard; Elements map on well to the emotional well-being objective in our hierarchy; Easy to use and complete (excel doc); Free.
- Cons: Answers depend on the opinion of the assessor/rater; Does not include objectives specific to rehab; Last updated in 2008.

20. Skin conductance

In terms of biometric measures, skin conductance could be used as an indicator of how much stress someone is experiencing.

21. Staff turn over and sick leave

The number of days of staff sick leave and/or the staff turn over could be used to give an indication of the extent of the staffs' emotional well-being.

22. Medication use for depression

A record of the number of prescriptions written up for depression medication could give an indication of patients' emotional well-being.

23. Count of the number of visitors

A count of the number of visitors each day may give an indication of the emotional well-being of both family/friends and patients. Presumably, patients will have better emotional well-being if they have more visits from family/friends. Conversely, family/friends may visit less often if the hospital environment is detrimental to their sense of emotional well-being.

24. Count of the number of wayfinding queries A count of the number of wayfinding queries would provide a measure of the means objective 'Maximise legibility of the space'. A more legible space would presumably result in fewer wayfinding queries from patients and visitors. This means objective impacts on a number of fundamental objectives, so counting the number of wayfinding queries may also provide a proxy measure of efficiency (in terms of cost and time), effectiveness, emotional well-being, and safety.

3.3.5 Measuring safety in the built environment

25. Count of the number of code greys

In a hospital setting, the term ‘code grey’ is used to refer to the incidence of a “personal threat” from one person to another person. The number of code greys could give an indication of how safe the staff, patients, and visitors are. The number of code greys may also give an indication of emotional well-being – the assumption being that a person who is experiencing emotional well-being will be less likely to express anger towards another person.

26. Reported injuries

All healthcare facilities routinely keep a record of the number of injuries reported by staff, patients, and visitors.

27. Falls per 1000 bed days

The number of patient falls per 1000 bed days is collected by most rehabilitation facilities as a standard measure of patient safety.

28. Safety Risk Assessment Tool from the Centre of Healthcare Design

The Centre of Healthcare Design has developed a Safety Risk Assessment Tool, which can be accessed for free from [here](#). This tool assess 6 areas of safety: Infection control, patient handling, medication safety, falls, behavioural health, and security. This tool encourages a systems thinking approach and is designed to be used by a multidisciplinary team of stakeholders early in the design process (it can be used in existing buildings, but this is not ideal). Everyone who has a role in providing safety at the facility should be involved in the Safety Risk Assessment. The tool is designed to facilitate a ‘process’ of Safety Risk Assessment, not to be used as a checklist. During this process, the multidisciplinary team would decide which aspects of safety are most important in their rehabilitation environment, then apply some of their historical safety data for that site, and then concentrate on the design considerations for that site. The Centre of Healthcare Design has a free user guide for this tool.

29. Health department building standards

All healthcare buildings must meet building codes of Australia - there are rehab standards for the building codes. It would be expected that all rehabilitation facilities will meet these standards, so there may be no variation in this measure between facilities.

4 Next steps

The research team will now choose a set of measurement tools from this list, combine them into an evaluation approach that fits with the hierarchy of objectives and then pilot this approach in a rehabilitation facility.

The methods and results from the workshops will be written up into a manuscript for publication which will be circulated to all workshop attendees once published. An abstract has been submitted to the European Healthcare Design Conference 2018.

5 References

- Andrade, C., Lima, M. L., Fornara, F., and Bonaiuto, M. (2012) ‘Users’ views of hospital environmental quality: Validation of the Perceived Hospital Environment Quality Indicators (PHEQIs)’, *Journal of Environmental Psychology*, 32, 97-111.
- Morgan-Brown, M. & Chard, G. (2014) ‘Comparing communal environments using the Assessment Tool for Occupation and Social Engagement: using interactive occupation and social engagement as outcome measures.’ *British Journal of Occupational Therapy*, 77(2).
- Keeney, R. L. (1992). *Value-focused thinking : a path to creative decisionmaking*: Cambridge, MA : Harvard University Press.

6 New additions to the glossary

A few discipline-specific terms came up during workshop 2 that needed defining. These are listed below along with their definitions. This list is in addition to the initial glossaries in the Workshop Handbook (which was circulated before workshop 1) and in the Workshop 1 Summary.

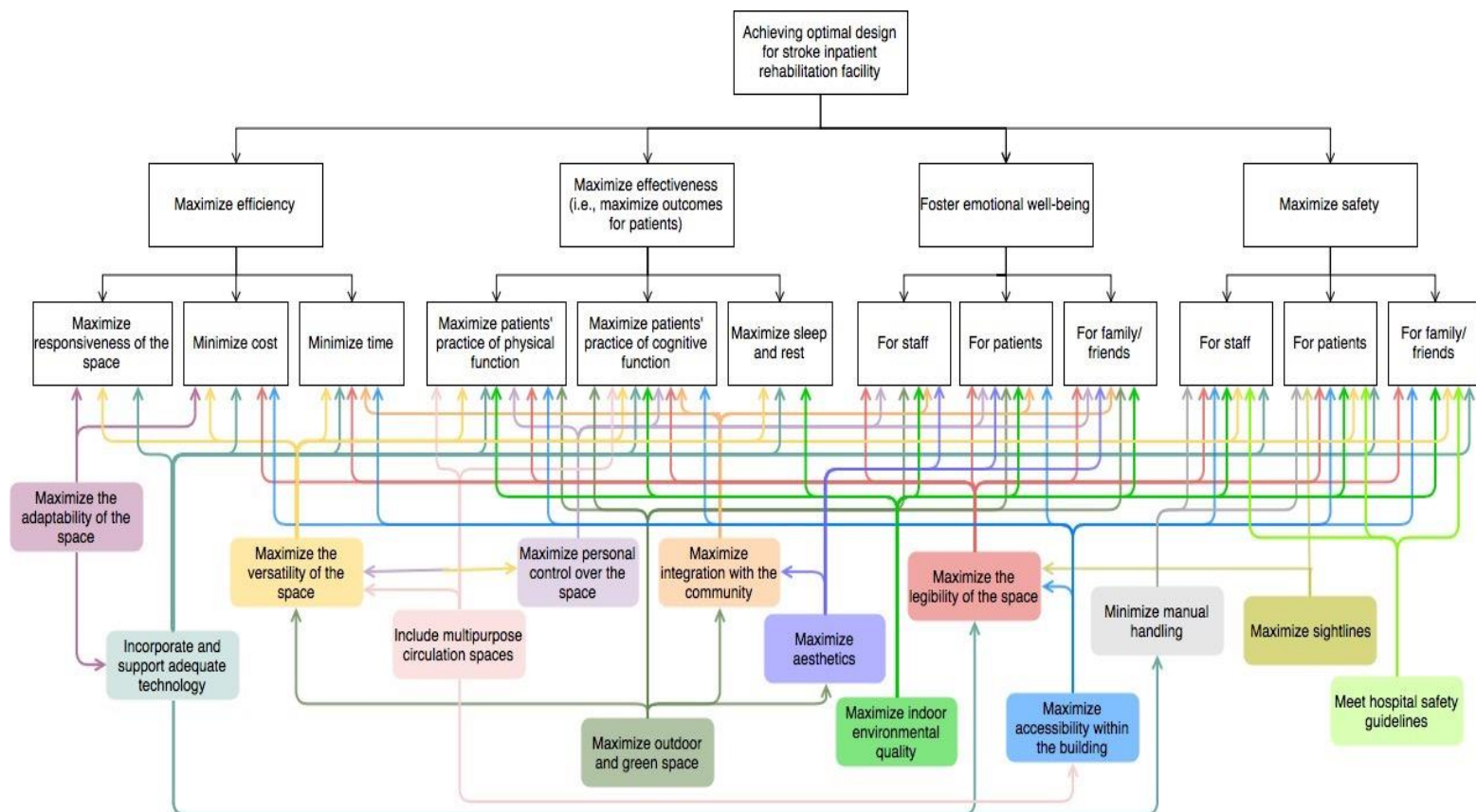
Word or phrase	Definition
Design Development (DD)	DD is a phase in the design of a building. During this phase the design moves from a concept/schematic formate to a more detailed/documented format.
Egress	The action of going out of or leaving a space. Is often used in combination with the term ‘access’ to describe how people enter and exit spaces, i.e. ”access and egress” is an important consideration for wayfinding.
Fenestration	The arrangement of windows in a building. ‘Fenestrate’ may be used to mean ‘add more windows’.
Grade changes	Changes in the level or incline of the floor or surface. Going up or down a level or floor involves a grade change, e.g., going from the first floor to the second floor. And changes in elevation also involve a grade change, e.g., going up or down a ramp or a small set of stairs involves a grade change, even if you don’t technically change floors.
Interstitial spaces	The space between objects or between other spaces.

Appendix 6: Supplementary material for Study 2 manuscript

The supplementary material for Lipson-Smith et al. (2019) is included in the following 17 pages.

Supplementary Material: Definitions of the Means Objectives

This supplementary material provides definitions of the 14 means objectives that were identified as important in the built environment of inpatient stroke rehabilitation facilities. These means objectives and the relationships between them and the fundamental objectives are displayed in Supplementary Figure 1 below.



Supplementary Figure 1

Maximize the Adaptability of the Space

The adaptability of a space refers to its ability to change in response to new knowledge or requirements, both at the level of the clinical program and at the level of the patient, and to be “future proof” (this term was used a number of times by participants in the workshops). In this

definition, ‘adaptability’ refers to changes that need to occur over the long-term (i.e., years or decades) and the mid-term (i.e., months or years), but not the short-term (i.e., hours or days). This concept of adaptability applies to both the fabric of the building (i.e. the overall layout and structure), and the internal fit-out of the building (i.e. the interior design, partitions, etc.). Mid- and long-term costs can be reduced if the building is designed from the outset to be able to adapt to changing requirements. This objective is a means to achieving the following fundamental objectives:

- **Maximize the responsiveness of space:** An adaptable space will be responsive to changing needs and requirements over the mid- and long-term.
- **Minimize cost:** Mid- and long-term costs are reduced if the building is designed from the outset to be able to adapt to changing requirements.
- **Incorporate and support adequate technology:** An adaptable space will accommodate for unprecedented knowledge growth and facilitate the introduction of new technologies.

Maximize the Versatility of the Space

The versatility of a space refers to its ability to change over the short-term (i.e., hours or days) in response to day-to-day changes in clinical programs or to meet the immediate needs of different people. In other words, the building should be customizable and have a “loose enough fit” (this term was used by participants in the workshops) so that it works for all users.

‘Versatility’ implies that the space should be customisable; some spaces may incorporate cues as to what the space could (or should) be used for, while other spaces may have no cues at all. Some spaces may be functionally agnostic, and some may be functionally suggestive, but what is important is that they are flexible enough to be used for different things at different times and to suit changing needs. This may involve defining the purpose of a space to a certain extent;

it should still be recognisable as being for a certain type of activity, but it should not be so tightly defined that it can't be modified to meet changing needs. Regardless of how prescriptive these spaces are, they should always be ready to be activated by an individual or group. For example: a therapy room should be able to accommodate both individual and group therapy, or different forms of therapy; a consult room that is normally used by just a patient and clinician should be able to accommodate the patients' extended family if they happen to visit during the consultation time; and a communal lounge should be able to support both the patient who needs low stimulation and intimate conversations and the patient who needs high stimulation and lots of activities. This objective is a means to achieving the following fundamental objectives:

- **Maximize the responsiveness of space:** A versatile space will be responsive to changing needs and requirements over the short-term.
- **Minimize cost:** A versatile space can serve many functions, thereby decreasing the number of different types of spaces that may need to be included in the finished building and reducing upfront costs.
- **Minimize time:** A versatile space can be quickly changed to suit needs, thereby minimizing time spent finding or developing an alternative, suitable space.
- **Maximize opportunities for practice of physical function and cognitive function and effective sleep and rest:** A versatile space can be designed to suit changing clinical needs so that it can continue to create suitable opportunities for practicing physical and cognitive function. A versatile space can also be altered to remain conducive to sleep as patients' needs, sensitivities, and preferences change, or in response to seasonal changes (e.g., longer daylight hours).
- **Maximize safety for staff and patients and family/friends:** Having versatile patient rooms with moveable walls would allow patient beds and occupancy to be changed in

response to infection control or behavioural needs, or to provide a line of sight or more supervision for patients at risk of falling.

- **Maximize personal control over the space:** A versatile space should allow for personal control, and a space that allows for personal control should be inherently more versatile. This is a bidirectional relationship. However, designers do need to ensure that both objectives are always being met as not all versatile spaces will automatically allow for personal control over the space.

Incorporate and Support Adequate Technology

A stroke rehabilitation facility should be designed to support the necessary technologies for administration and clinical practice, and the design should be flexible enough to adapt as these technologies evolve. In other words, the physical space needs to be designed to align with the technology. Many different forms of technology need to be considered including (but not limited to): Medical apparatuses, gym and therapy equipment, staff computers, public computers, staff and patients' personal devices (phones, tablets, laptops, etc.), pager systems, WiFi and mobile network signals, duress systems, and patient entertainment devices.

Here are some illustrative examples of the relationship between technology and the built environment. 1) If the WiFi is strongest in, e.g. the corridors, then people will congregate there, causing an accessibility problem and fire hazard, and the spaces designed for congregation will not be used. The WiFi signal should be accessible in all areas. 2) The placement of nurses stations, and the presence of computers at these stations, can influence how frequently medical records are updated and can impact on staff travel times within the building. 3) Swipe card access to certain areas of the building can impact on accessibility and patients' personal control over the space, but may also need to be considered in some areas to ensure safety. The building

should accommodate the technologies designed to maximize safety, e.g., equipment such as hoists can minimize the need for staff to manually handle patients. Adequate technology may also impact efficiency and effectiveness. This objective is a means to achieving the following fundamental objectives:

- **Maximize the responsiveness of space and Minimize cost and Minimize time:** There are many technological solutions designed to save time for staff, reduce costs, or make a space more responsive to the needs of its inhabitants (e.g., smart rooms). The building should support inclusion of these evidence-based technologies to improve efficiency.
- **Maximize opportunities for practice of physical function and cognitive function and effective sleep and rest:** There are many new technologies (e.g., robotics, interactive computer games, VR, etc.) designed to assist in the practice of physical and cognitive functions. The building should support inclusion of these evidence-based technologies to improve the effectiveness of therapy. There are also technologies that exist to promote effective sleep and rest (e.g. lighting for circadian rhythms).
- **Maximize safety for staff and patients and family/friends:** The building should accommodate evidence-based technologies designed to maximize safety (e.g., duress systems, floor sensors, smoke alarms).
- **Minimize manual handling:** Adequate technology (e.g., hoists) can minimize the need for staff to manually handle patients.
- **Maximize the legibility of the space:** Technology such as touch-screen information kiosks, and apps that provide information about the facility can support wayfinding.

Include Multipurpose Circulation Spaces

The corridors, or circulation spaces, make up a large proportion of the overall floor space of a building and, in a rehabilitation facility, they naturally serve many functions to support clinical operations. Corridors are used as unofficial social spaces, hosting incidental and natural social interaction. They are used as storage spaces that allow equipment and wheelchairs to be stored close to patients (which then facilitates patients being independently mobile). They are used as unofficial therapy spaces, and may well be the first place where a patient walks by themselves unassisted. The naturally multipurpose or versatile characteristic of corridors should be encouraged in rehabilitation facility design so that these spaces can continue to serve many functions, whilst still providing a means for safe, efficient circulation and travel. This objective is a means to achieving the following fundamental objectives:

- **Maximize opportunities for practice of physical function and cognitive function:**
Multipurpose corridors may encourage patients to emerge from their rooms and engage in incidental practice of physical and cognitive functions.
- **Maximize the versatility of the space:** Since circulation spaces make up a large proportion of the floorplan, multipurpose corridors can therefore be an economic use of space and can go a long way to ensuring that the facility as a whole has some element of versatility.
- **Maximize accessibility within the building:** Well-designed circulation spaces work to link key services and promote access throughout the building. Corridors should be wide enough to accommodate the many activities that naturally take place in these spaces so that the number of people and presence of equipment does not impact on safe transit throughout the facility.

Maximize Outdoor and Green Spaces

Outdoor space can be incorporated into the design of the building to provide views of nature from patients' rooms (especially from their beds), therapy areas, and communal areas. However, privacy also needs to be accommodated; the design should allow patients and staff to control the balance between views of the outdoors and privacy indoors. This objective is a means to achieving the following fundamental and means objectives:

- **Maximize opportunities for practice of physical function and cognitive function:**

Outdoor spaces provide more opportunities for practice of 'real world' physical function, and for social interaction. In addition, there is some evidence to suggest that nature itself is beneficial for brain repair.

- **Foster emotional well-being for staff and patients and family/friends:** Nature can be rejuvenating and relaxing, helping to combat stress for patients, staff, and visitors.
- **Maximize the versatility of the space:** Well-designed outdoor spaces can be incredibly versatile; they can be used by individuals or by large groups, and for many different types of activities.
- **Maximize integration with the community:** Outdoor spaces with public access can facilitate interaction with the community.

Maximize Personal Control Over the Space

Patients, staff, and visitors should be able to execute personal choices in regards to their environment. There are dichotomies of needs that exist in stroke rehabilitation that need to be accommodated. Relaxing and restorative spaces are needed to allow people to de-stress or contemplate, but patients may also need stimulating and energising spaces to create opportunities

for practicing cognitive function and to combat boredom. Similarly, there needs to be private or intimate spaces (both aurally and visually private) so that patients can be alone or just with loved ones, and there needs to be social or communal spaces that encourage social interaction and facilitate incidental peer-to-peer learning (which is emphasised in education settings). In addition, stroke can happen at any age, so it's important that patients can create age-appropriate spaces. Maximizing patient, staff, and visitor's control over the space allows them to create the appropriate balance between these dichotomies and to change this balance from day to day or hour to hour. This objective is a means to achieving the following fundamental objectives:

- **Maximize opportunities for practice of physical function and cognitive function:** Having personal control allows patients, staff, and visitors to change the space to suit clinical needs. In addition, a sense of agency may be key to motivating patients to practice physical and cognitive function.
- **Foster emotional well-being for staff and patients and family/friends:** Having personal control allows patients, staff, and visitors to change the space to suit their emotional and well-being needs. It also allows patients and visitors to introduce a level of normality, familiarity, or homeliness to their environment. In addition, having control introduces a sense of agency, which can be uplifting and empowering.
- **Maximize the versatility of the space:** A space that allows for personal control, i.e., that allows individuals to make their stamp on it and to change it to suit their needs, is inherently more versatile.

Maximize Integration With the Community

A stroke rehabilitation building should maximize the facility's integration with the wider community. The facility should be conveniently situated in relation to the existing community and in close proximity to associated health services. A rehabilitation facility that is integrated into the community should also contribute to the neighbourhood and become “more than just a hospital”, providing benefit to staff, patients, visitors, and the general public. Including public spaces within the facility (e.g., cafés, gardens, even the hydrotherapy pool) will encourage people in the community to use these spaces, and will introduce a sense of normalcy and a home-like atmosphere for patients. The street level of the building in particular should incorporate porous public space, and design consideration should be given to the identity of the building and how it contributes to the community. This objective is a means to achieving the following fundamental objectives:

- **Minimize time:** Integration in the community may minimize travel time for staff, patients, and visitors to get to the facility (i.e., easily accessible by car or public transport). This may minimize the time to transport patients from associated health services. The ease of the journey to and from the building is also important once a patient is discharged as they may be required to travel daily to attend therapy as an outpatient.
- **Maximize opportunities for practice of cognitive function:** Public spaces provide opportunities for both incidental and programmed practice of cognitive functions. An accessible location will encourage family and friends to visit, which may provide opportunities for social interaction and practicing cognitive function. In addition, having access to ‘normal’ facilities such as cafés provides opportunities for therapeutic practice of skills required in everyday life; an occupational therapist may work with a patient to go to the café and order a coffee and thereby practice the necessary cognitive functions.

- **Foster emotional well-being for staff and patients and family/friends:** Being integrated into the community introduces some level of normalcy for patients (and staff and visitors). It allows them to observe or participate in some aspects of normal life, with a comforting reminder of home, and introduces ready-made communal or social spaces. Access to public spaces within the hospital introduce a break in a patient's routine, combat boredom, and encourage social interaction. An accessible location may also encourage family and friends to visit, which may benefit the emotional well-being of patients.

Maximize Aesthetics

Our definition of ‘aesthetics’ refers to the beauty or attractiveness of the building, views, interior design, and any artwork in the space. This beauty or attractiveness may be visual, or it may be associated with one or more of the other senses (sound, smell, touch, taste). Aesthetics should be maximized in all areas of the facility including the patients' rooms, staff areas, therapy areas, communal spaces, and corridors/circulation spaces. This objective is a means to achieving the following fundamental and means objectives:

- **Foster emotional well-being for staff and patients and family/friends:** A better aesthetic may work to make users feel more positive.
- **Maximize integration with the community:** An aesthetically pleasing environment may act as a ‘draw-card’ and encourage people from the wider community to appreciate and integrate with the rehabilitation facility building (thereby potentially decreasing isolation for the patients and helping to foster their emotional well-being).

Maximize Indoor Environmental Quality

‘Indoor environment’ refers to air quality, light levels, access to natural light, ceiling heights, sound levels, views of the outdoors, and orientation to the sun. In addition to these general requirements, the indoor environment should be designed to suit the specific needs of patients with brain injury, who may have sensory or perceptual differences. Indoor environmental quality should be maximized in all areas of the facility including the patients’ rooms, staff areas, therapy areas, communal spaces, and corridors/circulation spaces. This objective is a means to achieving the following fundamental objectives:

- **Maximize opportunities for practice of physical function and cognitive function and effective sleep and rest:** Appropriate lighting and noise levels at night are essential to ensure good sleep and therefore good clinical outcomes for patients. Noise levels during therapy are also important so that the patient and staff can effectively communicate and concentrate.
- **Foster emotional well-being for staff and patients and family/friends:** A good indoor environment is integral for physical comfort and therefore emotional well-being.
- **Maximize safety for staff and patients and family/friends:** Air quality is of obvious importance in terms of infection control, and light and sound levels are important for staff attention and concentration (reduce medical errors) and for general occupational health and safety.

Maximizing the Legibility of the Space

A 'legible' space is easy to navigate and understand. Legibility of space, or wayfinding, is not just about signage, it is also about being able to predict, or anticipate how a space is laid out. Environmental cues (e.g., staircases and reception desks) can help people understand where to go and what different areas are for. Information provision is another key component of a legible space; patients and visitors need to be provided with information prior to their visit and upon arrival to facilitate their understanding of the space. The aim is for a stroke rehabilitation facility to have intuitive wayfinding, but, importantly, it must be intuitive for patients who have had a stroke and who may have cognitive impairments. Consideration should also be given to people with low literacy, people who do not speak English, and people with visual or other sensory impairments.

The entry to the rehabilitation facility can be a key component in ensuring the legibility of the entire facility. The arrival or entrance to a building forms the first impression of the building and is therefore very important and memorable. The entry should provide a clear demarcation that introduces the rehabilitation space as a different type of space, it should also create a sense of safety, and it should clearly indicate what different spaces are for. This objective is a means to achieving the following fundamental objectives:

- **Minimize cost and Minimize time:** Patients and visitors who feel disorientated or lost will ask staff for directions, which impacts on staff time (and therefore costs).

Disorientated patients may take longer to get to therapy and so therefore may leave therapists waiting (again impacting on staff time and costs).

- **Maximize opportunities for practice of physical function and cognitive function:**

Being oriented enough to move about yourself creates opportunities for practice of physical and cognitive function, and it allows people to access existing opportunities for

physical and cognitive function. Legible spaces also mean less time finding your way and getting lost, therefore leaving more time for incidental and deliberate practice.

- **Foster emotional well-being for staff and patients and family/friends:** Good wayfinding can reduce stress in a foreign environment and is especially important for people have a cognitive or physical impairment or who are experiencing fatigue. Getting lost or disorientated and having to walk further can sap energy and impact on pain levels.
- **Maximize safety for staff and patients and family/friends:** Legible spaces can help patients and visitors orient themselves, which is important for emergency evacuation.

Maximize Accessibility Within the Building

A rehabilitation building should be designed so that all staff, patients, and visitors can independently access the necessary parts of the facility in a timely fashion. There are a number of considerations that need to be taken into account in order to make a rehab building accessible including colocation of facilities, journey time within the building, access to services, and disability access.

Patient should not need to rely on staff in order to gain access to outdoor spaces, communal spaces, public on-site services (e.g. cafés), and therapy spaces. These spaces should be in a central location and circulation between these spaces and the wards should be designed to encourage patients to access these spaces independently (e.g., wall rails, minimize distances, no locked doors, etc.). Importantly, entry to these spaces should not be limited to the 9-5 working day. Rather than being organized around staff working hours, services such as cafés need to remain open and operational at times that coincide with the facility's visiting hours (e.g., evenings and weekends), otherwise they become inaccessible at the times at which patients and visitors would most benefit from them. Importantly, it is essential that people with a disability

can independently access all areas of the facility – this includes people who use a wheelchair or other mobility aids, and people who have a visual or other sensory impairment.

Accessibility can be improved by removing physical barriers wherever possible, including avoiding changing levels/floors, and colocating key rehabilitation services such as the gym, occupational therapy, and other allied health services. Designing for colocation requires a weighing of priorities; it's impossible to have all sections of the facility next to each other. Time should be spent in the design phase to map out usage patterns and travel times, and to discover the 'core' spaces and how they interact. This information can then be used to ensure that the facility's layout supports the service of care. This objective is a means to achieving the following fundamental objectives:

- **Minimize cost and Minimize time:** It is detrimental to both time and cost if staff have to travel long distances between patient rooms, porter patients to therapy, or wait for patients to get to therapy. The use of a single, remote therapy area may not be the right approach. Large wards with all majority single patient rooms may need to hire more nurses in order to ensure appropriate observation of patients, which is costly for the facility.
- **Maximize opportunities for practice of physical function and cognitive function:**
Having independent access to more spaces in the rehabilitation facility may give patients more opportunity to engage in incidental practice, or self-motivated deliberate practice. Therapy sessions with the physiotherapist, occupational therapist, or speech therapist are often scheduled for consecutive, short periods during the day, and travelling long distances between these sessions may cut into the patient's therapy time and so decrease their opportunities for deliberate practice of physical or cognitive functions. It could be argued that having to travel some distance to therapy may provide patients with an

opportunity for incidental physical practice en route, but if the distance is too large then patients will need to be portered to therapy and so any possibility of incidental practice is removed.

- **Foster emotional well-being for patients:** Arduous travel times within the building may make patients feel more incapable and reliant as they may need to depend more on staff to get from a to b. Being able to get to rehab by themselves may help patients to feel more agency and independence.
- **Maximize safety for staff and patients and family/friends:** Accessibility within a building is obviously important for emergency evacuation, and good sightlines may improve patient safety. However, there may also be a negative relationship between accessibility and safety; unhindered patient and visitor access within the rehabilitation facility may increase the risk of fall or injury for patients, and it may also make the facility more vulnerable to theft and other petty crimes. The benefits and risks of accessibility must be weighed during the design process. Many of the risks associated with accessibility may be alleviated by ensuring that the design facilitates good sightlines and integration with the community (both of which increase human observation throughout the space).
- **Maximize the legibility of the space:** People need to be able to access areas in order to familiarise themselves with those spaces. Accessible spaces with obvious, tangible functions can be easier to understand and navigate.

Minimize Manual Handling

Stroke rehabilitation facilities should be designed to minimize the amount of manual handling that staff need to do when lifting or moving patients or equipment by hand. This is a fundamental occupational health and safety issue. Suitable technologies (e.g., hoists, trollies, etc.) should be included (see ‘incorporate and support adequate technology’ above), but other design choices will also be important in minimizing manual handling (e.g., railings and corridor width). Storage spaces for equipment should be easily accessible (i.e., at appropriate heights and close to patient areas); and distances between key facilities and services (e.g., bed and toilet) should be minimized. In addition, the design should be flexible enough to adapt as new manual handling solutions are developed. This objective is a means to achieving the following fundamental objectives:

- **Maximize safety for staff and patients:** Less manual handling should mean fewer injuries for staff and patients.

Maximize Sightlines

The design of stroke rehabilitation facilities should allow people to easily see across key spaces. However, the objective of maximizing sightlines needs to be weighed up against the need for private spaces. This conflict could be addressed by ensuring that patients, staff, and visitors can exercise personal control over the space. This objective is a means to:

- **Maximize safety for patients:** Good sightlines allow staff to readily observe a number of patients simultaneously. This may be a means to reducing falls risk without restricting patients’ physical activity.

- **Maximize the legibility of the space:** Being able to see your destination, or your starting point, makes the space more legible and predictable. Clear orientation for patients, plus welcoming and accessible views of spaces, will help motivate patients to move around the facility, contributing to their sense of autonomy and help foster independent movement and incidental practice throughout a facility.

Meet Hospital Safety Guidelines

Stroke rehabilitation facilities should meet or exceed the building safety requirements or guidelines as laid down by the appropriate governing agency. These guidelines should stipulate, among other things, fire safety measures (e.g., number and placement of fire extinguishers, fire exit signage, etc.), balcony railing height, security cameras and monitoring, duress systems, etc.

Although much of these guidelines may be the same as for any public building, some alterations may need to be made for a stroke rehabilitation setting (e.g., larger holding spaces to accommodate more people in wheelchairs in the case of fire). This objective is a means to achieving the following fundamental objectives:

- **Maximize safety for staff and patients and family/friends:** Standard building safety guidelines are required to insure the minimum safety standards are met for a public building.

Appendix 7: Ethics approvals for Study 3

The ethics approvals from St Vincent's Hospital Melbourne and Bendigo Health are included in the following pages.



11 September 2018

Professor Julie Bernhardt
The Florey Institute of Neuroscience and Mental Health

Dear Prof Bernhardt

HREC Reference Number: HREC/18/SVHM/210

St Vincent's HREC Ref: HREC 136/18

'The ENVIRONS (ENVironments for Inpatient Rehabilitation of Stroke patients) study: A multiple-case study to understand how the built environment of inpatient stroke rehabilitation facilities may best promote efficiency, effectiveness, emotional well-being, and safety.'

I am pleased to advise that the above project has received **ethical approval** from the St Vincent's Hospital Melbourne Human Research Ethics Committee (HREC)

HREC Approval Date: 11 September 2018

This HREC is accredited by the Consultative Council for Human Research Ethics under the single ethical review system. The HREC has ethically approved this research according to the Memorandum of Understanding between the Consultative Council and the participating organisations conducting the research.

Approval is given in accordance with the research conforming to the National Health and Medical Research Council Act 1992 and the National Statement on Ethical Conduct in Human Research 2007 (*updated May 2015*)

Ethical approval for this research project has been given at the following sites.

- St George's Health Service, Kew
- Bendigo Health

Please note that each participating site will require governance approval (SSA approval) prior to commencement of this research project.

Site-Specific Assessment - Governance

SSA authorisation is required at all sites participating in the study. SSA must be authorised at a site before the research project can commence.

You are now required to forward this HREC approval letter with an electronic copy of the approved documents named above to the Principal Investigator(s) and the Research Governance Officer (s) at each participating site covered by this HREC approval. Each participating site must issue governance approval of the project before the study can commence at individual sites.

Approval is subject to:

- **An Annual Progress Report (that covers all sites listed on approval) for the duration of the project. This report is due on the 01 May each year for the duration of the project. Continuation of ethics approval is contingent on submission of an annual report. Failure to comply with this requirement may result in suspension of the project by the HREC.**
- The Principal Researcher is to ensure that all associate researchers are aware of the terms of approval and to ensure the project is conducted as specified in the application and in accordance with the National Statement on Ethical Conduct in Human Research 2007 (including all updates)
- The Principal Researcher is to notify the Research Governance Unit of all significant safety issues in accordance with the *NHMRC Guidance: Safety monitoring and reporting in clinical trials involving therapeutic goods (including all updates)*.
- Submit an Annual Safety Report for the duration of the project.
- Immediate notification of any unforeseen events that may affect the continuing ethical acceptability of the project;
- Notification and reasons for ceasing the project prior to its expected date of completion;
- Submit to the reviewing HREC for approval of any proposed amendments to the project including any proposed changes to the Protocol, Participant Information and Consent Form/s, Investigator Brochure and other study materials.
- Submission of reviewing HREC approval for any proposed modifications to the project.
- Submission of a final report and papers published on completion of project.
- Projects may be subject to an audit or any other form of monitoring by the Research Governance Unit at any time.

The following documents have been reviewed and approved:

Approved documents:

Document	Version	Date
Human Research Ethics Application (AU/1/8017320)	1.3.1 (2018)	13 June 2018
Victorian Specific Module	February 2018	27 July 2018
ENVIRONS Study Protocol	2	18 July 2018
ENVIRONS study Appendix A of protocol	1	19 June 2018
Master Participant Information and Consent Form for patients	2	18 July 2018
Master Participant Information and Consent Form for patients-aphasia friendly	2	18 July 2018
Master Participant Information and Consent Form for staff	2	18 July 2018
Admission Case Report Form	2	18 July 2018
Discharge Case Report Form	2	18 July 2018
Demographics Case Report Form	2	18 July 2018

Contact Details Form	2	18 July 2018
Questionnaires	2	18 July 2018
Questionnaires - aphasia friendly	2	18 July 2018
Semi-structured walk-through interview with patients	2	18 July 2018
Structured interview with staff	1	19 June 2018
Change of CPI Letter signed by Prof Julie Bernhardt	-	14 August 2018
Study Budget	-	19 June 2018

Noted documents:

Document	Version	Date
Curriculum Vitae - Dr Faraz Jeddi	-	April 2017
Curriculum Vitae - Dr Heidi Zeeman	-	-
Curriculum Vitae - Professor Julie Bernhardt	-	-
Curriculum Vitae - Ms Janine Simondson	-	29 May 2018
Curriculum Vitae - Ms Leanne Muns	-	-
Curriculum Vitae - Ms Ruby Lipson-Smith	-	-
Changes to HREA for ENVIRONS study	2	18 July 2018

This research study has received governance approval to be conducted at St Vincent's Hospital Melbourne

Approved Governance documents:

Document	Version	Date
Site Specific Assessment (Project ID: 41118)	-	31 July 2018
St George's Participant Information and Consent Form for patients	1	18 July 2018
St George's Participant Information and Consent Form for patients-aphasia friendly	1	18 July 2018
St George's Participant Information and Consent Form for staff	1	18 July 2018
Research Collaborative Agreement	-	31 August 2018

Noted documents:

Document	Version	Date
GCP certificate - Dr Faraz Jeddi	-	04 April 2014
GCP certificate - Dr Heidi Zeeman	-	30 July 2018
GCP certificate - Professor Julie Bernhardt	-	29 July 2014
GCP certificate - Ms Janine Simondson	-	27 August 2018
GCP certificate - Ms Leanne Muns	-	16 July 2018
GCP certificate - Ms Ruby Lipson-Smith	-	20 January 2017

HREC Reference Number: HREC/18/SVHM/210
St Vincent's HREC Ref: HREC 136/18

The HREC wishes you and your colleagues every success in your research.

Yours sincerely,



Ms Akshaya Ravi

Intern

Research Governance Unit

St Vincent's Hospital (Melbourne)



Ms Leanne Clinch

HREC Secretary

Research Governance Unit

St Vincent's Hospital (Melbourne)

RESEARCH GOVERNANCE / SITE SPECIFIC ASSESSMENT (SSA) AUTHORISATION

to conduct a research project at Bendigo Health Care Group

Ms Leanne Muns
Bendigo Hospital
100 Barnard Street
Bendigo
Vic, 3550

12 October 2018

Dear Leanne,

Project Title	The ENVIRONS (ENVironments for Inpatient Rehabilitation of Stroke patients) study: A multiple-case study to understand how the built environment of inpatient stroke rehabilitation facilities may best promote efficiency, effectiveness, emotional well-being
Project ID	41118
Review Reference	SSA/41118/BHCG-2018-153708(v1)
Local Reference Number	SSA/18/BHCG/41118

I am pleased to advise that the above project is authorised to be conducted at Bendigo Health Care Group . This authorisation is subject to compliance with the conditions set out below and any conditions specified by the reviewing Human Research Ethics Committee (HREC).

Authorised Documents

Document Type	File Name	Date	Version
Curriculum vitae	Investigator CV L Muns	22/08/2018	1
Curriculum vitae	Investigator CV F Jeddi	22/08/2018	1
Curriculum vitae	Investigator CV R Lipson-Smith	22/08/2018	1
Evidence of GCP training	GCP certificate LM 2018	22/08/2018	1
Evidence of GCP training	Dr Jeddi Faraz- GCP- 04 Apr 2014	22/08/2018	1
Evidence of GCP training	GCP cert Ruby Lipson-Smith	22/08/2018	1
Evidence of GCP training	GCP Certificate Refresher_v1_RubyLipson-Smith	22/08/2018	1
Copy of ethics approval	HREC 136.18 -Final Approval_11.09.18	11/09/2018	1
Participant information and consent form	ENVIRONS_Bendigo PICF patients_Version 1_17SEP2018	17/09/2018	1
Participant information and consent form	ENVIRONS_Bendigo PICF patients aphasia friendly_Version 1_17SEP2018	17/09/2018	1
Participant information and consent form	ENVIRONS_Bendigo PICF staff_Version 1_17SEP2018	17/09/2018	1

Conditions of Research Governance Authorisation

As Principal Investigator, you are required to:

1. Comply with the Investigator's responsibilities as outlined in the *Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95)*.
2. Submit a copy of this letter to the person responsible for radiation safety at Bendigo Health Care Group. This condition only applies if the project involves exposure to ionising radiation that exceeds dose constraints, and the Medical Physicist's report has advised that the project needs to be added to the site's *Licence for Research Involving Human Volunteers* issued by the Department of Health and Human Services Radiation Safety Section (for more information, visit www2.health.vic.gov.au/public-health/radiation). *Note: If the Medical Physicist's report has advised that the project needs to be added to the site's licence, the project cannot commence at site until you have confirmed that the project has been added to the site's licence.*
3. Notify the Research Governance Officer (RGO) of:
 - The actual start date of the project at this site.
 - Any amendments to the project after these have been approved by the reviewing HREC.
 - Any adverse events involving patients at this site, in accordance with [Safety Monitoring and Reporting in Clinical Trials Involving Therapeutic Goods](#) (NHMRC, 2016).
 - Any changes to the indemnity, insurance arrangements or Clinical Trial Research Agreement (CTRA) for this project. This includes changes to the project budget or other changes which may have financial or other resource implications at this site.
 - Your inability to continue as Principal Investigator or any other change in site research personnel involved in this project.
 - Failure to commence the research project within 12 months of the research governance authorisation date or if a decision is taken to end the research project at this site.
 - Any other unforeseen events.
 - Any other matters which may impact the conduct of the project at this site.
4. Ensure that HREC approval remains current for the entire duration of the project. Investigators undertaking projects without current reviewing HREC approval risk their indemnity, funding and publication rights.
5. Submit an annual progress report every 12 months for the duration of the project. This report is due on the anniversary of HREC approval. Continued research governance authorisation is contingent on receipt of an annual report by the RGO. In addition, a comprehensive final report should be submitted to the RGO upon completion of the project.

You must also abide by the following requirements:

1. Where applicable, ensure that the CTN has been electronically lodged to the TGA by the sponsor.
2. For clinical trials where the site is the sponsor, you are required to contact the RGO to organise submission of the electronic Clinical Trial Notification (e-CTN) to the TGA. This must be completed before commencement of your project.
3. It is the Principal Investigator's responsibility to ensure that copies of the complete submitted e-CTN and TGA issued acknowledgement are included in the study site file for the project at this site.
4. Ensure that the Clinical Trial Research Agreement (CTRA) and indemnities (or other research agreements as applicable) are fully executed, i.e. signed by all parties; and an original version (or copy) placed in the study file.

The RGO may conduct an audit of the research project at any time.

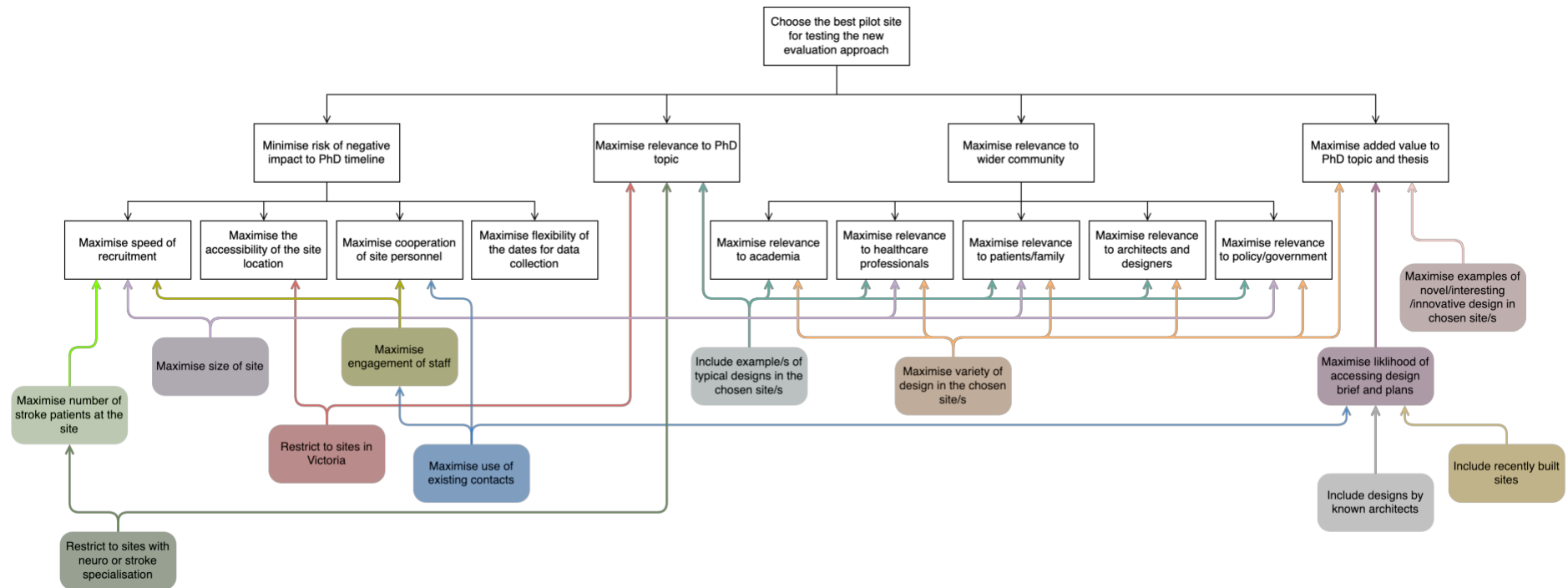
If any matters arise regarding conduct of the research at this site, please contact the RGO via the ERM 'Correspond' button or 03 5454 6412. I wish you and your colleagues every success in your research.

Yours sincerely,



Ms Sally McCarthy
Research Manager
Bendigo Health

Appendix 8: Criteria used to select the two cases for Study 3



Appendix 9: Questionnaire booklets for Study 3

The regular questionnaire booklet (which is 17 pages) and the aphasia-friendly questionnaire booklets (34 pages) are included in the following pages. Note that additional data were also collected in Study 3 that fell outside the scope of this thesis and will instead be reported in future publications participants. Namely, in addition to the questionnaires listed in Section 4.8.2, participants were also asked to complete the Supportive Hospital Environment Design Scale (SHEDS) (Andrade & Devlin, 2015; Andrade et al., 2017), and The Perceived Competence Scale (PCS) and Treatment Self-Regulation Questionnaire (TSRQ), which measure two distinct aspects of motivation as defined by Self-Determination Theory (Deci & Ryan, 1985).

The SHEDS is designed to measure the extent to which patients perceive the environment to provide them with personal control, positive distraction, and social support. It was developed to test Ulrich's Theory of Supportive Design, which is described in Section 1.4.3. In future publications, results from the stress subscale of the DASS will be compared to results on the SHEDS to investigate whether patient stress is mediated by the extent to which they perceive the environment to provide them with personal control, positive distraction, and social support.

The PCS assesses how confident participants feel about being able to make (or maintain) a change in behaviour. People who feel more competent are more likely to be motivated to make and maintain the change. The PCS has been adapted and used in many contexts including health care (Williams, Freedman, & Deci, 1998). The TSRQ is designed to assess the degree to which a person's motivation for a particular behavior or set of behaviors is relatively autonomous or self-determined (Ryan & Connell, 1989; Williams, Grow, Freedman, Ryan, & Deci, 1996). The association between motivation and environment will be investigated in future publications.

The ENVIRONS study

Questionnaires

Site: _____

Participant ID number: _____

Date started: ____ / ____ / ____

Time started: _____ AM / PM

Date finished: ____ / ____ / ____

Time finished: _____ AM / PM

Date data entered: ____ / ____ / ____

If found, please contact:

Ruby Lipson-Smith, PhD student researcher
 Florey Institute of Neuroscience and Mental Health
 245 Burgundy Street, Heidelberg VIC 3084
 Ph: +61 3 9035 7130; 0402 167 360
 Email: ruby.lipson-smith@florey.edu.au

MONTREAL COGNITIVE ASSESSMENT (MOCA®)

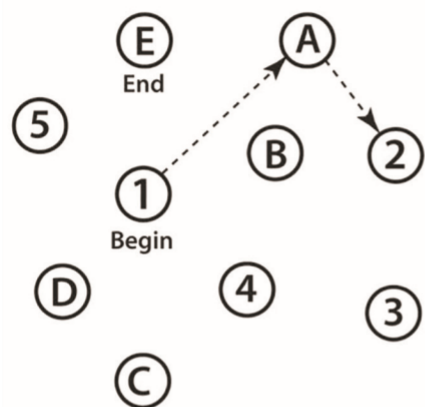
Version 8.1 English

Education:

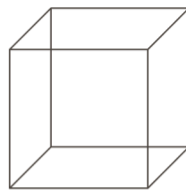
Sex:

Date of birth:

DATE:

VISUOSPATIAL/EXECUTIVE

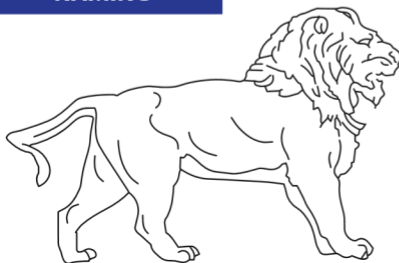
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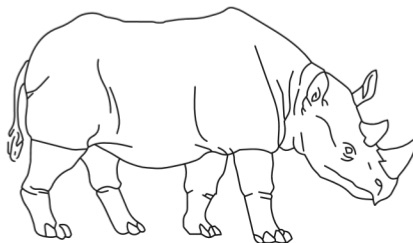
[]

Draw **CLOCK** (Ten past eleven)
(3 points)[]
Contour[]
Numbers[]
Hands

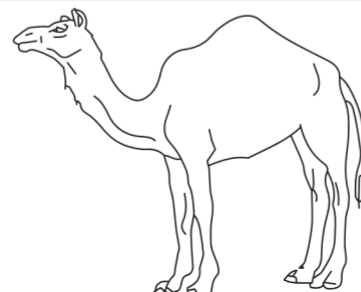
___/5

NAMING

[]



[]



[]

___/3

MEMORY

Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1 ST TRIAL					
2 ND TRIAL					

ATTENTION

Read list of digits (1 digit/ sec.).

Subject has to repeat them in the forward order.

[] 2 1 8 5 4

Subject has to repeat them in the backward order.

[] 7 4 2

___/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

[] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B

___/1

Serial 7 subtraction starting at 100.

[] 93

[] 86

[] 79

[] 72

[] 65

4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0**

___/3

LANGUAGE

Repeat: I only know that John is the one to help today. []

The cat always hid under the couch when dogs were in the room. []

___/2

Fluency: Name maximum number of words in one minute that begin with the letter F.

[] _____ (N ≥ 11 words)

___/1

ABSTRACTION

Similarity between e.g. banana - orange = fruit [] train - bicycle [] watch - ruler

___/2

DELAYED RECALL

(MIS)	Has to recall words WITH NO CUE	FACE	VELVET	CHURCH	DAISY	RED	Points for UNCUE recall only
X3		[]	[]	[]	[]	[]	
X2	Category cue						
X1	Multiple choice cue						

MIS = ___/15

___/5

ORIENTATION

[] Date [] Month [] Year [] Day [] Place [] City

___/6

© Z. Nasreddine MD

www.mocatest.org

MIS: /15

(Normal ≥ 26/30)

Administered by: _____

Training and Certification are required to ensure accuracy

Add 1 point if ≤ 12 yr edu

TOTAL

___/30

Study ID:

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of time	Applied to me very much, or most of the time	
0	1	2	3	
1. I found it hard to wind down	0	1	2	3
2. I was aware of dryness of my mouth	0	1	2	3
3. I couldn't seem to experience any positive feeling at all	0	1	2	3
4. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5. I found it difficult to work up the initiative to do things	0	1	2	3
6. I tended to over-react to situations	0	1	2	3
7. I experienced trembling (eg, in the hands)	0	1	2	3
8. I felt that I was using a lot of nervous energy	0	1	2	3
9. I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10. I felt that I had nothing to look forward to	0	1	2	3
11. I found myself getting agitated	0	1	2	3
12. I found it difficult to relax	0	1	2	3
13. I felt down-hearted and blue	0	1	2	3
14. I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15. I felt I was close to panic	0	1	2	3
16. I was unable to become enthusiastic about anything	0	1	2	3
17. I felt I wasn't worth much as a person	0	1	2	3
18. I felt that I was rather touchy	0	1	2	3

The rating scale is as follows:

	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of time	Applied to me very much, or most of the time
	0	1	2	3
19.	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)			0 1 2 3
20.	I felt scared without any good reason			0 1 2 3
21.	I felt that life was meaningless			0 1 2 3

The following questions relate to your usual sleep habits during the past week. Your answers should indicate the most accurate reply for the majority of days and nights in the past week. Please answer all questions.

During the past week:

1. What time have you usually gone to bed at night? _____
2. How long (in minutes) has it usually taken you to fall asleep each night? _____
3. What time have you usually gotten up in the morning? _____
4. How many hours of actual sleep did you get at night? _____
(This may be different than the number of hours you spent in bed.)

5. During the past week, how often have you had trouble sleeping because you:	Not during the past week (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
a. Cannot get to sleep within 30 minutes	0	1	2	3
b. Wake up in the middle of the night or early morning	0	1	2	3
c. Have to get up to use the bathroom	0	1	2	3
d. Cannot breathe comfortably	0	1	2	3
e. Cough or snore loudly	0	1	2	3
f. Feel too cold	0	1	2	3
g. Feel too hot	0	1	2	3
h. Had bad dreams	0	1	2	3
i. Have pain	0	1	2	3
j. Other reason(s), please describe and indicate how often you have had trouble sleeping because of these reasons:	0	1	2	3

6.	During the past week, how would you rate your sleep quality overall?	Very good 0	Fairly good 1	Fairly bad 2	Very bad 3
7.	During the past week, how often have you taken medicine to help you sleep (prescribed or "over the counter")?	Not during the past week 0	Less than once a week 1	Once or twice a week 2	Three or more times a week 3
8.	During the past week, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	Not during the past week 0	Less than once a week 1	Once or twice a week 2	Three or more times a week 3
9.	During the past week, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	Not a problem at all 0	Only a very slight problem 1	Somewhat of a problem 2	A very big problem 3

MSBS

Study ID:

Please respond to each question indicating how you feel right now about yourself and your life, even if it is different from how you usually feel.

Use the following choices:

Strongly disagree 1	Disagree 2	Somewhat disagree 3	Neutral 4	Somewhat agree 5	Agree 6	Strongly agree 7
----------------------------------	----------------------	----------------------------------	---------------------	-------------------------------	-------------------	-------------------------------

1. Time is passing by slower than usual.	1	2	3	4	5	6	7
2. I am stuck in a situation that I feel is irrelevant.	1	2	3	4	5	6	7
3. I am easily distracted.	1	2	3	4	5	6	7
4. I am lonely.	1	2	3	4	5	6	7
5. Everything seems to be irritating me right now.	1	2	3	4	5	6	7
6. I wish time would go by faster.	1	2	3	4	5	6	7
7. Everything seems repetitive and routine to me.	1	2	3	4	5	6	7
8. I feel down.	1	2	3	4	5	6	7
9. I seem to be forced to do things that have no value to me.	1	2	3	4	5	6	7
10. I feel bored.	1	2	3	4	5	6	7
11. Time is dragging on.	1	2	3	4	5	6	7
12. I am more moody than usual.	1	2	3	4	5	6	7
13. I am indecisive or unsure of what to do next.	1	2	3	4	5	6	7
14. I feel agitated.	1	2	3	4	5	6	7
15. I feel empty.	1	2	3	4	5	6	7
16. It is difficult to focus my attention.	1	2	3	4	5	6	7
17. I want to do something fun, but nothing appeals	1	2	3	4	5	6	7
18. Time is moving very slowly.	1	2	3	4	5	6	7
19. I wish I was doing something more exciting.	1	2	3	4	5	6	7
20. My attention span is shorter than usual.	1	2	3	4	5	6	7

Use the following choices:											
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree					
1	2	3	4	5	6	7					
21.	I am impatient right now.				1	2	3	4	5	6	7
22.	I am wasting time that would be better spent on something else.				1	2	3	4	5	6	7
23.	My mind is wandering.				1	2	3	4	5	6	7
24.	I want something to happen but I'm not sure what.				1	2	3	4	5	6	7
25.	I feel cut off from the rest of the world.				1	2	3	4	5	6	7
26.	Right now it seems like time is passing slowly.				1	2	3	4	5	6	7
27.	I am annoyed with the people around me.				1	2	3	4	5	6	7
28.	I feel like I'm sitting around waiting for something to happen.				1	2	3	4	5	6	7
29.	It seems like there's no one around for me to talk to.				1	2	3	4	5	6	7

Please respond to each of the following items in terms of how true it is for you with respect to participating in rehabilitation activities (both in therapy and in your free time).

Rehabilitation activities may include: physical activity (e.g., practicing walking, standing, using your arm/s), thinking tasks (e.g., reading, playing games), practicing everyday tasks (e.g., making tea, getting dressed), or socialising with other people.

Use this scale:

Not at all true				Somewhat true				Very true
1	2	3	4	5	6	7		

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. I feel confident in my ability to participate in rehabilitation activities. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I now feel capable of taking part in rehabilitation activities. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I am able to do my rehabilitation activities over the long term. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I am able to meet the challenge of rehabilitation activities. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

There are a variety of reasons why people choose to participate in rehabilitation activities. Please indicate how true each of the following reasons is for you in regards to why you participate in rehabilitation activities (both in therapy and in your free time).

Use this scale:

Not at all true 1	2	3	Somewhat true 4	5	6	Very true 7
-------------------------	---	---	-----------------------	---	---	----------------

I try to participate in rehabilitation activities (in therapy and in my free time):

1. Because I feel that I want to take responsibility for my own recovery.	1	2	3	4	5	6	7
2. Because I would feel guilty or ashamed of myself if I did not participate in rehabilitation activities.	1	2	3	4	5	6	7
3. Because I personally believe it is the best thing for my recovery.	1	2	3	4	5	6	7
4. Because others would be upset with me if I did not.	1	2	3	4	5	6	7
5. I really don't think about it.	1	2	3	4	5	6	7
6. Because I have carefully thought about it and I believe it is very important for many aspects of my life.	1	2	3	4	5	6	7
7. Because I would feel bad about myself if I did not participate in rehabilitation activities.	1	2	3	4	5	6	7
8. Because it is an important choice I really want to make.	1	2	3	4	5	6	7
9. Because I feel pressure from others to do so.	1	2	3	4	5	6	7
10. Because it is easier to do what I am told than think about it.	1	2	3	4	5	6	7
11. Because it is consistent with my life goals.	1	2	3	4	5	6	7
12. Because I want others to approve of me.	1	2	3	4	5	6	7
13. Because it is very important for recovering as well as possible.	1	2	3	4	5	6	7
14. Because I want others to see I can do it.	1	2	3	4	5	6	7
15. I don't really know why.	1	2	3	4	5	6	7

Thinking about the ward that you are in now, please indicate on the line below how much you think the physical environment helps you to feel motivated to participate in rehabilitation activities (both in therapy and in your free time)?

The physical environment may include: the building, the furniture and objects in the building, how the rooms are arranged, views, outdoor spaces.

When answering this question, please focus on the physical environment only. Try not to think about other things like quality of care, staff or family support (just imagine that you had the best care & treatment, best staff, and best family support imaginable).

The physical environment strongly hinders (i.e., makes it harder to feel motivated)		The physical environment strongly helps (i.e., makes it easier to feel motivated)
--	--	--

SHEDS

Study ID:

Please think about the elements and amenities that this building provides. Thinking about these elements, please select the number that best describes how much you agree or disagree with the phrases below.

The rating scale is as follows:

Strongly
disagree
1

Disagree
somewhat
2

Neither agree or
disagree
3

Agree
somewhat
4

Strongly agree
5

1.	In this building I can easily access all of the amenities that I want to access (e.g., tea-making facilities, laundry facilities, etc.).	1	2	3	4	5
2.	This hospital building allows me to enjoy the company of visiting family and friends.	1	2	3	4	5
3.	There are objects that attract my attention in my room at this hospital.	1	2	3	4	5
4.	In my room at this hospital I am able to control the surrounding environment as needed (e.g. noise levels, light levels, temperature, etc.).	1	2	3	4	5
5.	My room at this hospital provides a supportive environment for visiting family and friends.	1	2	3	4	5
6.	I feel that I have permission to come and go from my room at this hospital whenever I want to.	1	2	3	4	5
7.	My attention is drawn to interesting things in this hospital building.	1	2	3	4	5
8.	There are choices I can make about the physical features of my room at this hospital.	1	2	3	4	5
9.	In my room at this hospital I am absorbed by the surroundings.	1	2	3	4	5
10.	I determine the organization/appearance of my room at this hospital.	1	2	3	4	5
11.	My room at this hospital allows me to socialize/"get together" with visiting family and friends.	1	2	3	4	5
12.	I like how this hospital building looks.	1	2	3	4	5
13.	There are places in this building where I can go by myself or with visiting family and friends to practice my skills outside of my therapy time.	1	2	3	4	5

The rating scale is as follows:						
	Strongly disagree 1	Disagree somewhat 2	Neither agree or disagree 3	Agree somewhat 4	Strongly agree 5	
14.	My family and friends feel comfortable in my room at this hospital.			1	2	3 4 5
15.	My attention is drawn to interesting things in my room at this hospital.			1	2	3 4 5
16.	I can easily access all of the parts of this building that I want to access.			1	2	3 4 5
17.	My room at this hospital allows me to enjoy the company of visiting family and friends.			1	2	3 4 5
18.	There is plenty that I want to linger on in my room at this hospital.			1	2	3 4 5
19.	I can control the physical features and materials of my room at this hospital.			1	2	3 4 5
20.	This hospital building makes it easy for me to socialize/“get together” with visiting family and friends.			1	2	3 4 5
21.	I can adjust, re-arrange, and re-organize things in my room at this hospital as needed.			1	2	3 4 5
22.	My family and friends feel comfortable in this hospital building.			1	2	3 4 5
23.	There is plenty that I want to linger on in this hospital building.			1	2	3 4 5

Use this page for notes, comments, or questions:

The ENVIRONS study

Questionnaires

Site: _____

Participant ID number: _____

Participant initials: _____

Date started: ____ / ____ / ____

Time started: _____ AM / PM

Date finished: ____ / ____ / ____

Time finished: _____ AM / PM

Date data entered: ____ / ____ / ____

If found, please contact:

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 Email: ruby.lipson-smith@florey.edu.au

MONTREAL COGNITIVE ASSESSMENT (MOCA®)

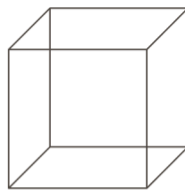
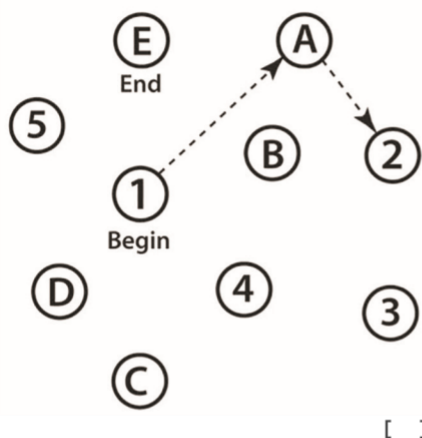
Version 8.1 English

Education:

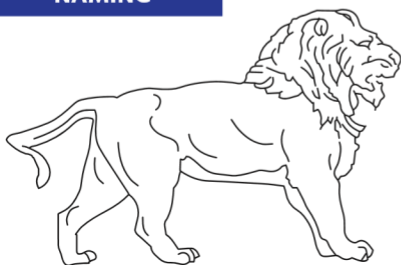
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Date of birth:

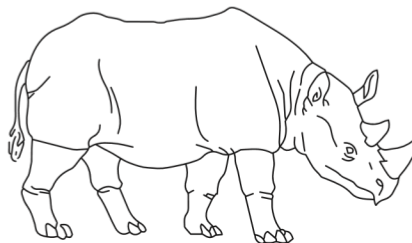
DATE:

VISUOSPATIAL/EXECUTIVECopy
cubeDraw CLOCK (Ten past eleven)
(3 points)
☐ Contour ☐ Numbers ☐ Hands

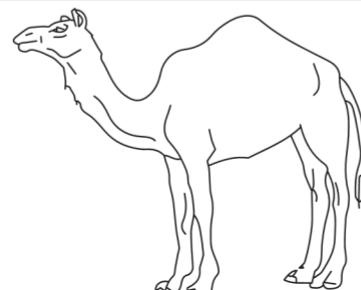
___/5

NAMING

[]



[]



[]

___/3

MEMORY

Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1 ST TRIAL					
2 ND TRIAL					

ATTENTION

Read list of digits (1 digit/ sec.).

Subject has to repeat them in the forward order.

[] 2 1 8 5 4

Subject has to repeat them in the backward order.

[] 7 4 2

___/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

[] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B

___/1

Serial 7 subtraction starting at 100.

[] 93

[] 86

[] 79

[] 72

[] 65

4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0**

___/3

LANGUAGE

Repeat: I only know that John is the one to help today. []

The cat always hid under the couch when dogs were in the room. []

___/2

Fluency: Name maximum number of words in one minute that begin with the letter F.

[] _____ (N ≥ 11 words)

___/1

ABSTRACTION

Similarity between e.g. banana - orange = fruit [] train - bicycle [] watch - ruler

___/2

DELAYED RECALL

(MIS)		FACE	VELVET	CHURCH	DAISY	RED	Points for UNCUE recall only
X3	Has to recall words WITH NO CUE	[]	[]	[]	[]	[]	
X2	Category cue						
X1	Multiple choice cue						

MIS = ___/15

___/5

ORIENTATION

[] Date [] Month [] Year [] Day [] Place [] City

___/6

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www.mocatest.org

MIS: /15

(Normal ≥ 26/30)

Administered by: _____

Training and Certification are required to ensure accuracy

Add 1 point if ≤ 12 yr edu

TOTAL

___/30

Study ID:

Please read each statement and **circle a number 0, 1, 2 or 3** which indicates **how much** the statement **applied to you** over the **past week**. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

**Did not
apply to me
at all**

0

Applied to me
to **some
degree**, or
some of the
time

1

Applied to me to a
**considerable
degree**, or a good
part of time

2

Applied to me
very much,
or most of the
time

3

1. I found it **hard to wind down**

0 **1** **2** **3**

2. I was aware of **dryness** of my **mouth**

0 **1** **2** **3**

3. I **couldn't** seem to **experience** any **positive feeling** at all 0 1 2 3

4. I experienced **breathing difficulty** (eg, excessively rapid breathing, breathlessness in the absence of physical exertion) 0 1 2 3

5. I found it **difficult** to work up the **initiative** to do things 0 1 2 3

6. I tended to **over-react** to situations 0 1 2 3

7. I experienced **trembling** (eg, in the hands) 0 1 2 3

8. I **felt** that I was using a lot of **nervous energy** 0 1 2 3

9. I was **worried** about situations in which I might **panic** and make a **fool of myself** 0 1 2 3

10. I **felt** that I had **nothing** to look forward to 0 1 2 3

11. I found myself getting **agitated** 0 1 2 3

12. I found it **difficult to relax** 0 1 2 3

13. I felt **down-hearted** and blue 0 1 2 3

14. I was **intolerant** of anything that **kept me** from getting on with what I was **doing** 0 1 2 3

15. I felt I was close to **panic** 0 1 2 3

16. I was **unable** to become **enthusiastic** about anything 0 1 2 3

17. I **felt** I **wasn't worth much** as a person

0 1 2 3

18. I **felt** that I was rather **touchy**

0 1 2 3

19. I was **aware** of the action of my **heart** in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)

0 1 2 3

20. I **felt scared** without any good reason

0 1 2 3

21. I **felt** that life was **meaningless**

0 1 2 3

The following questions relate to your usual **sleep habits** during **the past week only**. Your answers should indicate the most accurate reply for the **majority** of days and nights in the past week.

During the past week:

1. What **time** have you usually gone to **bed at night**? _____

2. **How long** (in minutes) has it usually **taken** you to **fall asleep** each night? _____

3. What **time** have you usually gotten **up in the morning**? _____

4. **How many hours** of actual **sleep** did you get **at night**?
(This may be different than the number of hours you spent in bed.) _____

5. During the past week, **how often** have you had **trouble sleeping** because you:

	Not during the past week	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes	0	1	2	3
b. Wake up in the middle of the night or early morning	0	1	2	3
c. Have to get up to use the bathroom	0	1	2	3
d. Cannot breathe comfortably	0	1	2	3

e. **Cough** or **snore** loudly 0 1 2 3

f. **Feel too cold** 0 1 2 3

g. **Feel too hot** 0 1 2 3

h. Had **bad dreams** 0 1 2 3

i. Have **pain** 0 1 2 3

j. **Other reason(s)**, please describe:

How often have you
had trouble sleeping
because of these other
reasons?

0

1

2

3

6. During the past week,
how would you **rate** your
sleep quality overall?

**Very
good**

**Fairly
good**

**Fairly
bad**

**Very
bad**

0

1

2

3

7. During the past week,
how often have you
taken **medicine to help
you sleep** (prescribed or
"over the counter")?

**Not
during
the
past
week**

**Less
than
once a
week**

**Once
or
twice a
week**

**Three
or
more
times a
week**

0

1

2

3

8. During the past week, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	Not during the past week 0	Less than once a week 1	Once or twice a week 2	Three or more times a week 3
---	---	--	---	---

9. During the past week, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	Not a problem at all 0	Only a very slight problem 1	Some- what of a problem 2	A very big problem 3
--	---	---	--	---

Please respond to each question indicating **how you feel** right now **about yourself** and **your life**, even if it is different from how you usually feel.

Use the following choices:



**Strongly
disagree**

1

Disagree

2

**Somewhat
disagree**

3

Neutral

4

**Somewhat
agree**

5

Agree

6



**Strongly
agree**

7

1. **Time** is passing by **slower** than usual.

1

2

3

4

5

6

7

2. **I am stuck** in a situation that I **feel** is irrelevant.

1

2

3

4

5

6

7

3. I am easily **distracted**.

1 2 3 4 5 6 7

4. I am **lonely**.

1 2 3 4 5 6 7

5. Everything seems to be **irritating**
me right now.

1 2 3 4 5 6 7

6. I **wish time** would go by **faster**.

1 2 3 4 5 6 7

7. Everything seems **repetitive** and
routine to me.

1 2 3 4 5 6 7

8. I **feel down**.

1 2 3 4 5 6 7

9. I seem to be **forced to do things** 1 2 3 4 5 6 7
that have **no value** to me.

10. I **feel bored**. 1 2 3 4 5 6 7

11. **Time** is **dragging** on. 1 2 3 4 5 6 7

12. I am **more moody** than usual. 1 2 3 4 5 6 7

13. I am **indecisive** or **unsure** of what 1 2 3 4 5 6 7
to do next.

14. I **feel agitated**. 1 2 3 4 5 6 7

15. I **feel empty**.

1 2 3 4 5 6 7

16. It is **difficult** to **focus** my attention.

1 2 3 4 5 6 7

17. I **want** to do something **fun**, but
nothing appeals

1 2 3 4 5 6 7

18. **Time** is moving very **slowly**.

1 2 3 4 5 6 7

19. I **wish** I was **doing** something
more exciting.

1 2 3 4 5 6 7

20. My **attention** span is **shorter** than
usual.

1 2 3 4 5 6 7

21. I am **impatient** right now.

1 2 3 4 5 6 7

22. I am **wasting time** that would be better spent on something else.

1 2 3 4 5 6 7

23. My **mind** is **wandering**.

1 2 3 4 5 6 7

24. I want **something to happen** but I'm **not sure** what.

1 2 3 4 5 6 7

25. I feel **cut off** from the **rest of the world**.

1 2 3 4 5 6 7

26. Right now it seems like **time** is
passing slowly.

1 2 3 4 5 6 7

27. I am **annoyed with** the **people**
around me.

1 2 3 4 5 6 7

28. I **feel** like I'm sitting around **waiting**
for something to happen.

1 2 3 4 5 6 7

29. It seems like there's **no one**
around for **me to talk to.**

1 2 3 4 5 6 7

Please respond to each of the following items in terms of **how true** it is **for you** with respect to **participating in rehabilitation** activities (**both in therapy and in your free time**).

Rehabilitation activities may include: physical activity (e.g., practicing walking, standing, using your arm/s), **thinking tasks** (e.g., reading, playing games), **practicing everyday tasks** (e.g., making tea, getting dressed), or **socialising** with other people.

Use this scale:



**Not at
all true**

1

2

3

**Somewhat
true**

4

5

6



**Very
true**

7

- I feel confident in my ability to participate in rehabilitation activities.**

1 2 3 4 5 6 7

2. **I now feel capable of taking part in rehabilitation activities.** 1 2 3 4 5 6 7

3. **I am able to do my rehabilitation activities over the long term.** 1 2 3 4 5 6 7

4. **I am able to meet the challenge of rehabilitation activities.** 1 2 3 4 5 6 7

There are a variety of **reasons why** people **choose** to participate in **rehabilitation** activities. Please indicate **how true** each of the following reasons is **for you** in regards to **why you participate** in **rehabilitation** activities (**both in therapy and in your free time**).

Use this scale:



Not at
all true

1

2

3

Somewhat
true

4

5

6



Very
true

7

I try to participate in **rehabilitation** activities (**in therapy and in my free time**):

1. **Because I feel that I want to take responsibility for my own recovery.** 1 2 3 4 5 6 7

2. **Because I would feel guilty or ashamed** 1 2 3 4 5 6 7
of myself **if I did not** participate in
rehabilitation activities.

3. **Because I personally believe** it is the 1 2 3 4 5 6 7
best thing for my recovery.

4. **Because others would be upset with me** 1 2 3 4 5 6 7
if I did not.

5. I really **don't think about it.** 1 2 3 4 5 6 7

6. **Because I have carefully thought** about 1 2 3 4 5 6 7
it and **I believe** it is **very important** for
many aspects of my life.

7. **Because I would feel bad about myself if I did not participate** in rehabilitation activities. 1 2 3 4 5 6 7

8. **Because it is an important choice I really want to make.** 1 2 3 4 5 6 7

9. **Because I feel pressure from others to do so.** 1 2 3 4 5 6 7

10. **Because it is easier to do what I am told than think about it.** 1 2 3 4 5 6 7

11. **Because it is consistent with my life goals.** 1 2 3 4 5 6 7

12. **Because I want others to approve of** 1 2 3 4 5 6 7
me.

13. **Because it is very important for** 1 2 3 4 5 6 7
recovering as well as possible.

14. **Because I want others to see I can do it.** 1 2 3 4 5 6 7

15. **I don't really know why.** 1 2 3 4 5 6 7

Thinking about **the ward** that you are in now, please **indicate on the line** below **how much you think** the **physical environment** helps **you to feel motivated** to participate in **rehabilitation** activities (**both in therapy and in your free time**)?

The **physical environment** may include: the **building**, the **furniture** and objects in the building, how the **rooms** are arranged, **views**, **outdoor spaces**.

When answering this question, please **focus on the physical environment only**. Try not to think about other things like quality of care, staff or family support (just imagine that you had the best care & treatment, best staff, and best family support imaginable).



The physical environment
strongly hinders
(i.e., makes it
harder to feel
motivated)



The physical environment
strongly helps
(i.e., makes it
easier to feel
motivated)

Please **think about** the **elements and amenities** that **this building** provides. Thinking about these elements, please **select the number** that best describes how much you **agree or disagree** with the phrases below.

The rating scale is as follows:



Strongly
disagree
1

Disagree
somewhat
2

Neither agree
or disagree
3

Agree
somewhat
4



Strongly
agree
5

1. In this building **I can easily access** all of the **1 2 3 4 5**
amenities that I want to access (e.g., tea-
making facilities, laundry facilities, etc.).

2. This **hospital building** allows me to enjoy **1 2 3 4 5**
the company of visiting **family and friends**.

3. There are **objects** that **attract my attention** 1 2 3 4 5
in **my room at this hospital**.

4. In **my room at this hospital** I am able to 1 2 3 4 5
control the surrounding **environment** as
needed (e.g. noise levels, light levels,
temperature, etc.).

5. **My room at this hospital** provides a 1 2 3 4 5
supportive environment for visiting **family**
and **friends**.

6. I **feel** that I have **permission** to **come and** 1 2 3 4 5
go from my room at this hospital **whenever I**
want to.

7. My **attention** is drawn to **interesting things** 1 2 3 4 5
in this **hospital building**.

8. There are **choices** I can make about the **physical features of my room at this hospital.** 1 2 3 4 5

9. In **my room at this hospital** I am **absorbed** by the **surroundings.** 1 2 3 4 5

10. I **determine** the **organization/appearance** of **my room at this hospital.** 1 2 3 4 5

11. **My room at this hospital** allows me to **socialize/“get together”** with visiting **family** and **friends.** 1 2 3 4 5

12. I **like** how this **hospital building** looks. 1 2 3 4 5

13. There are **places in this building** where I **1 2 3 4 5**
can go by myself or with **visiting family**
and friends to **practice my skills** outside of
my therapy time.

14. My **family** and **friends feel comfortable** in **1 2 3 4 5**
my room at this hospital.

15. My **attention** is drawn to **interesting things** **1 2 3 4 5**
in my room at this hospital.

16. **I can easily access** all of the **parts of this** **1 2 3 4 5**
building that **I want to access.**

17. **My room at this hospital** allows me to **enjoy** **1 2 3 4 5**
the **company** of visiting **family** and **friends.**

18. There is **plenty** that I want to **linger on in** 1 2 3 4 5
my room at this hospital.

19. I can **control** the **physical features** and 1 2 3 4 5
materials of my room at this hospital.

20. This **hospital building** makes it **easy for me** 1 2 3 4 5
to socialize/“get together” with visiting
family and friends.

21. I can **adjust, re-arrange, and re-organize** 1 2 3 4 5
things in my room at this hospital as
needed.

22. My **family and friends feel comfortable in** 1 2 3 4 5
this hospital building.

23. There is **plenty** that I want to **linger on** in this **1 2 3 4 5**
hospital building.

DASS₂₁

**Did not
apply to me
at all**

0

Applied to me
to **some**
degree, or
some of the
time

1

Applied to me to a
considerable
degree, or a good
part of time

2

Applied to me
very much,
or most of the
time

3

MSBS & TSRQ



**Strongly
disagree**

1

Disagree

2

**Somewhat
disagree**

3

Neutral

4

**Somewhat
agree**

5

Agree

6

**Strongly
agree**

7



SHEDS



**Strongly
disagree**

1

**Disagree
somewhat**

2

**Neither agree
or disagree**

3

**Agree
somewhat**

4

**Strongly
agree**

5



Appendix 10: Walk-through semi-structured interview

schedule for Study 3

ENVIRONS Study

Semi-structured walk-through interview with patients

Instructions for interviewer

- *The content and route of this walk-through semi-structured interview should be largely guided by the participant, not the interviewer. However, participants can be encouraged to access each of the following standard spaces: the patient's bedroom/bathroom; any shared dining/recreation spaces including kitchenette; any outdoor therapy and/or recreation space/s; therapy spaces including the gym, ADL rooms, and consult rooms; meeting spaces; and common areas of the facility including entryway, reception desks, and corridors.*
- *The role of the interviewer is to ensure that all of the participants' ideas/opinions/thoughts are explored in full.*
- *The interviewer can use prompts to encourage the participant to explore an idea further or to consider a new avenue.*
 - *A list possible prompts are included below.*
 - *These should be used to encourage participants to address the criteria that are considered important in the design of inpatient stroke rehabilitation facilities.*
 - *However, prompts should be tailored to the participant and based on their activity and the locations in which it took place during behavioural mapping.*
 - *You will probably need to use other prompts/questions in addition to those listed below in order to respond appropriately to participants.*
- *You can encourage the participant to draw/take photos to expand on their ideas.*

Preamble read by researcher to introduce the interview to the participant

- Thank you for agreeing to complete this interview.
- The purpose of the interview is to understand how you experience the physical environment of the building that we are in.
- During the interview we will move around the rehab ward, taking any route that you choose.
 - You can move around the ward in any way you choose e.g. walking, wheelchair, walking frame, and/or frequent breaks to sit down.
- The interview will take about 1 hour, but the time will depend a bit on your answers.
 - You can take as many breaks as you like during the interview.
 - You can also stop the interview at any time if you want to. You can stop the interview for any reason or no reason.
- When we start the interview, please take me (the interviewer) on a tour of the inpatient rehabilitation ward.
 - Imagine that you are showing the building to someone who doesn't know the space, and who wants to know what you do in the building, where you do these things, why you do them in these places, and how the different parts of the building make you feel.
 - You can talk about things that you like, and things that you don't like.
 - Where you go on the tour is up to you – just go to all of the places that you spend time, that you have an opinion about, or that you think are important.
 - If it helps you to express what you think, then you can draw pictures or take photographs of parts of the environment that are important to you. **Please do not include any people or things that might identify a person in your photographs.**
 - The researcher will also draw a map of where you decide to go on the tour.

- With your permission, the interview will be audio-recorded so that the researchers can listen back to the recording later when they are putting together the results of this research. **[Start audio-recording.]**

To understand patient's overall experience

- Why did you bring me to this space/room?
- Why did you take that photograph/draw that drawing?
- Is there anything about this space/room that is important to you?
 - Is there anything about this space/room that you like/dislike?
 - Is there anything in this space/room that you want to take a photo of?
- Overall, what does this space/room (or ward) feel like to you?
 - What other type (or types) of building or spaces does it remind you of? Why?
 - How does this space/room (or ward) make you feel?
- What do you do in the evenings and weekends in this space? How is this different from what you do during the day on a weekday?
- If you were talking to your daughter/friend/husband on the phone, how would you describe the design or environment of this space/room (or ward)?
- If you could change anything about the space/room (or ward) what would you change? What would you not want changed about the space?
 - Have you spent time in other rehab facilities before? Or other hospitals? How does this one compare?

To encourage visiting more spaces during the walk-through interview

- Are there any other places in the ward (or building) that you would like to take me/that you would show to someone who has never been to this place before?
- Yesterday/the day before yesterday, you did [activity/inactivity] in [room/space]. Is this somewhere you would like to take me?

General probes to elicit more information

Taken from Gillham, B. (2005).

- Clarifying: I don't quite understand that, can you explain it to me?
- Showing understanding: How did you feel about that?
- Justifying: What makes you say that?
- Relevance: You've lost me, how do those two things connect?
- Asking for an example: What do you mean by...? Can you give me an example?
- Extending the narrative: Tell me more about that.
- Accuracy: Now, let me see if I've got things in the right order?

Specific probes to elicit more information

Practice of physical and cognitive (inc. social) functions:

- What do you do when you're here?
 - Yesterday/the day before yesterday, you did [activity/inactivity] in this space.
- Why do you/don't you do these things here?
- Do you think this space provides you with opportunities to practice physical activities? Or to do activities that require thinking? Or to socialise?

- Apart from your scheduled therapy, what do you think your opportunities are for getting practice doing physical things, things that involve thinking, or socialising?
- What do you think influences the amount of practice that you get (this could be something about the built environment, or it could be something else)?
- Does the space make you feel motivated to practice doing physical things, things that involve thinking, or socialising?
 - Where do you feel most motivated? Why?
 - What sorts of spaces help you to feel motivated? Why?
 - What do you think most motivates you (this could be something about the built environment, or it could be something else)?

Sleep and rest:

- Tell me about how your sleep and rest has been since you have been on this ward?

Emotional well-being:

- How do you think this space interacts with your own emotional well-being?
 - How does this space/room make you feel?
 - How do you think this space/room interacts with your mood?
- How do you think this space interacts with the emotional well-being of staff (i.e. how they feel in themselves)?
- How do you think this space interacts with the emotional well-being of family/friends/visitors (i.e. how they feel in themselves)?

Safety

- Do you feel safe here?
- How do you think this space/room interacts with or impacts your safety?
- How do you think this space interacts with or impacts the safety of staff?

- How do you think this space interacts with or impacts the safety of family/friends/visitors?

Other criteria in the framework:

- Is there any technology in this space/room that you think is important? What is it used for?
- Can this space/room be used for more than one thing/task/activity? Is it used for more than one thing?
 - What about the corridors/foyers? What do you use them for? Are they used for more than one thing?
- Do you feel like you have control over what is in this space/how it looks/what you use it for?
- Do you have access to outdoor/green space? Do you use it? Why/why not?
- Do you feel like this facility is integrated with the wider community/outside world? Why/why not?
- Any comments about noise/smells/air quality/light?
- Are places in this building hard or easy to find? Did you have trouble finding rooms/spaces or understanding what they are for?
- Are there any spaces that are 'off-limits'/that you can't get in to/can't access without permission? Why?

Summary at end of interview

- *[Interviewer provides summary of what was discussed.]*
- Do you have any other comments about the design or environment of this ward?
- Would you like an opportunity to review an audio-recording, transcript, or summary of your interview before it is analysed?

Interviewer thanks participant for their time and stops audio-recording.

Appendix 11: Behavioural mapping data collection form for Study 3

ENVIRONS Behavioural Mapping Spreadsheet _20180831

ASSESSOR ID _____

Date: _____ Data entered into data base: _____

Time: _____ Ob #: _____ Patient ID _____

UNOBSERVED

1=offward; 2=door/curtain; 3=loc. unknown; 4=obs. break; 5=other (specify) _____

ACTIVITY ESTIMATED

LOCATION					
	communal areas	bedroom			
		amenities			
		dining room			
		outdoor courtyard			
		hallway/staff desk			
		therapy rooms/gym			
		off unit			
		other (specify)			
PEOPLE PRESENT	Specify number of people	medical staff			
		nurses			
		other patients			
		therapists			
		visitors			
		others (specify)			
		alone			
ACTIVITY	Physical	repositioning in bed			
		activities in sitting			
		standing up/transfers			
		standing			
		mobilising-self-propel WC			
		mobilising-walk			
		ADLs			
		PADLs			
		use affected arm			
		therapy			
		other (specify)			
		Cognitive	music/radio/audio book		
	puzzles/games/jigsaw				
	writing/art				
	reading				
	interactive gaming				
	computer				
	tablet				
	therapy				
	Social	touch/contact			
		talking			
		laughing			
		phone			
		group activity			
other (specify)					
Total number of people present					
POSITION (lying/sitting/upright)					
SLEEPING					
NO ACTIVITY (if no activity, specify what they were doing)					

Comments

1 _____

2 _____

3 _____

Appendix 12: Photographs of both cases in Study 3

Case 1 (St George's)

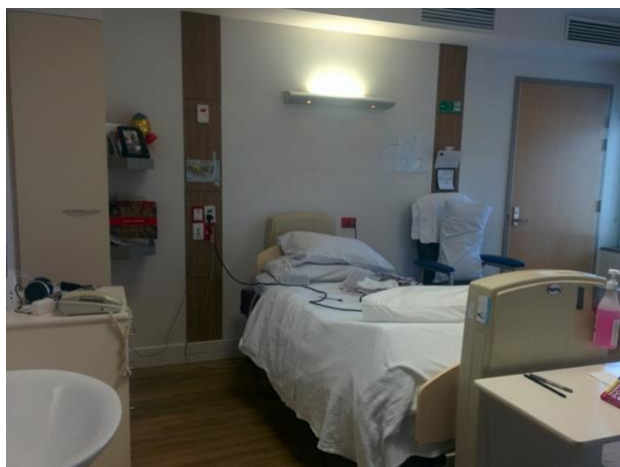


(a)



(b)

Photograph A12.1 Case 1 - St George's Health Service, Victoria. Image 1(a) shows the street view, and Image 1(b) shows an aerial view. The red arrow indicates the front entrance of the hospital in both images.



Photograph 12.2 Case 1 two single-bed rooms on rehabilitation ward (1st floor)



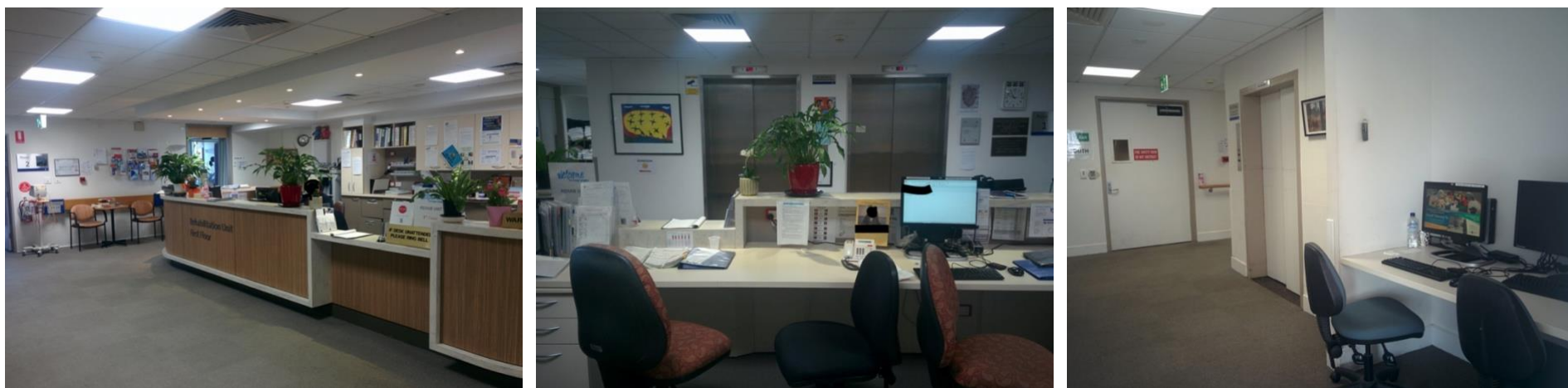
Photograph A12.3 Case 1 a four-bed room on rehabilitation ward (1st floor)



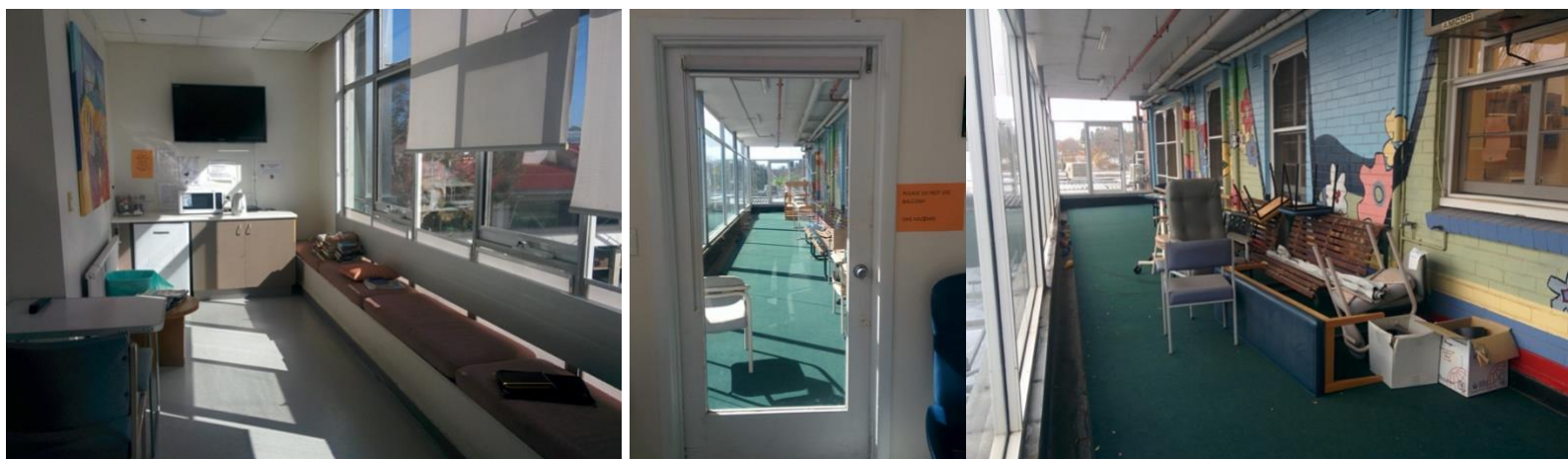
Photograph A12.4 Case 1 transition care bedroom on the rehabilitation ward (1st floor)



Photograph A12.5 Case 1 corridors on rehabilitation ward (1st floor)



Photograph A12.6 Case 1 nurses' station and staff computers on rehabilitation ward (1st floor)



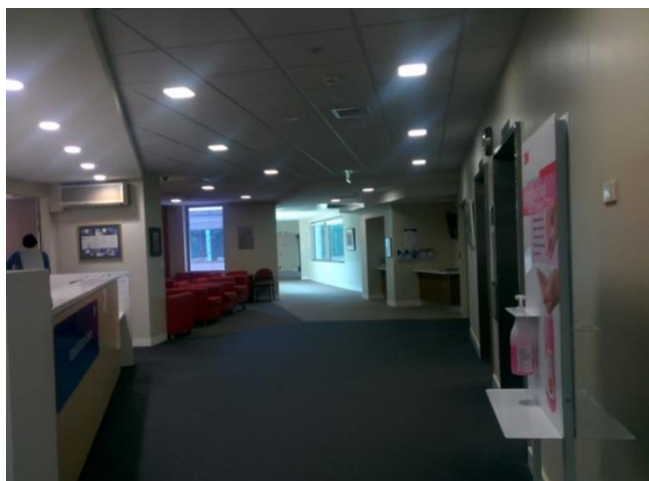
Photograph A12.7 Case 1 ward lounge ("sunroom") and balcony (off limits) on rehabilitation ward (1st floor)



Photograph A12.8 Case 1 gym on ground floor



Photograph A12.9 Case 1 therapy kitchen (left) and occupational therapy room (middle and right) on ground floor



Photograph A12.10 Case 1 chairs in corridor on ground floor



Photograph A12.11 Case 1 therapy garden on ground floor

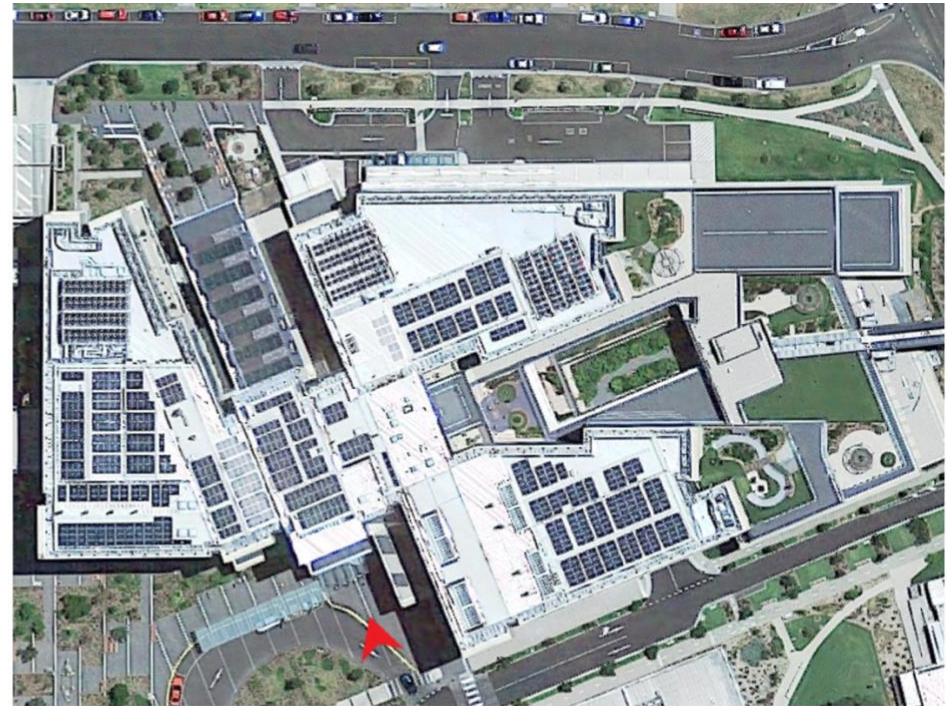


Photograph A12.12 Case 1 café indoor (left) and outdoor area (right) on ground floor

Case 2 (Bendigo)



(a)

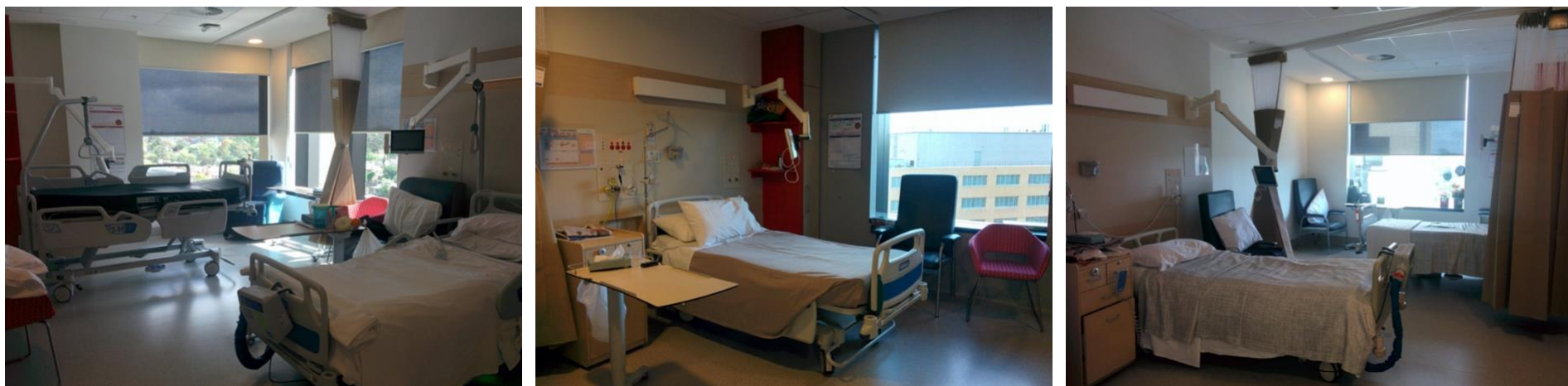


(b)

Photograph A12.13 Case 2 - Bendigo Health, Victoria. Image 2(a) shows the street view, and Image 2(b) shows an aerial view. The red arrow indicates the front entrance of the hospital in both images. This hospital provides emergency, acute, outpatients, and general medical services to the region. The rehabilitation ward is on the sixth floor.



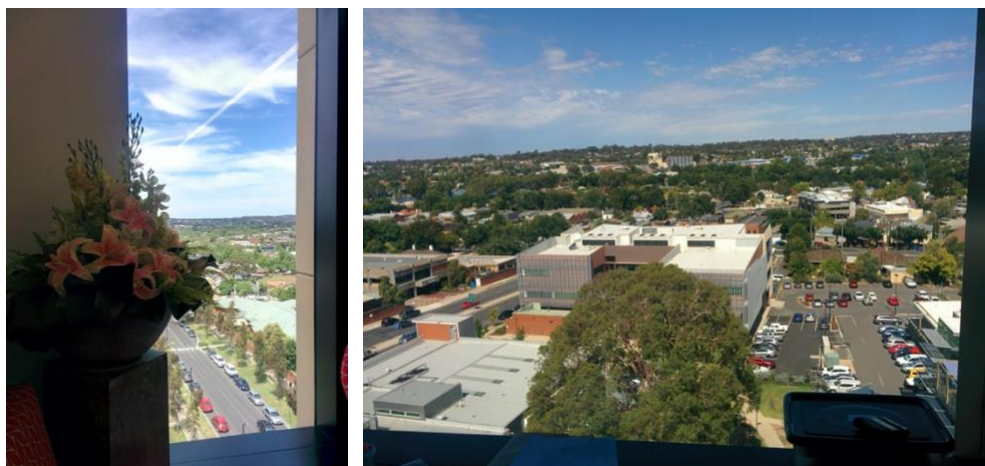
Photograph A12.14 Case 2 two single-bed rooms on the rehabilitation ward (6th floor)



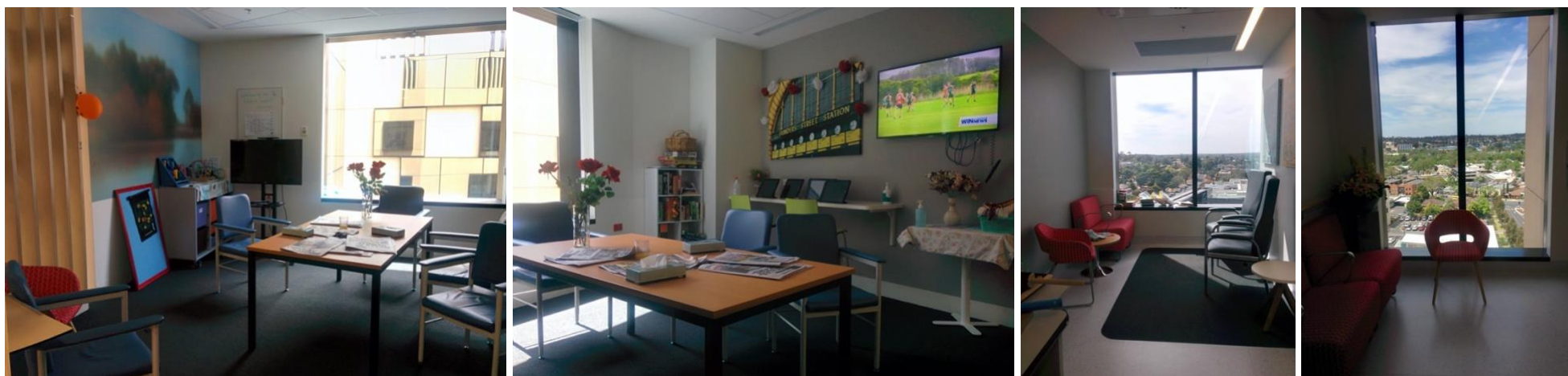
Photograph A12.15 Case 2 two-bed shared bedrooms on the rehabilitation ward (6th floor)



Photograph A12.16 Case 2 corridors on the rehabilitation ward (left) and environmental enrichment station on the rehabilitation ward (right) (6th floor)



Photograph A12.17 Case 2 view from windows on the rehabilitation ward (6th floor)



Photograph A12.18 Case 2 ward lounge (left) and lounge nook in the corridor (right) on the rehabilitation ward (6th floor)



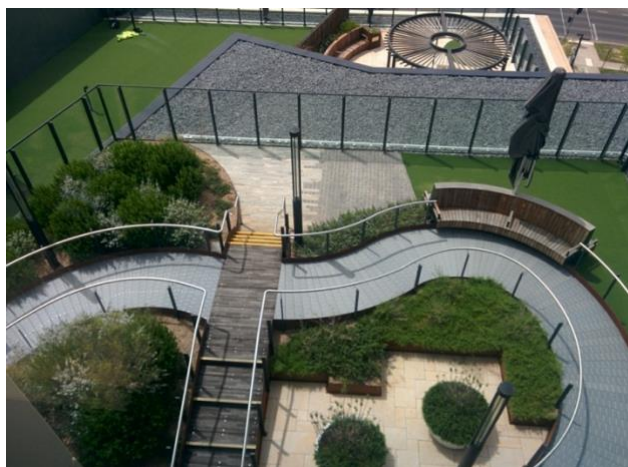
Photograph A12.19 Case 2 staff handover room on the rehabilitation ward (left) and kitchenette on rehabilitation ward (right) (6th floor)



Photograph A12.20 Case 2 therapy gym (6th floor)



Photograph A12.21 Case 2 community room

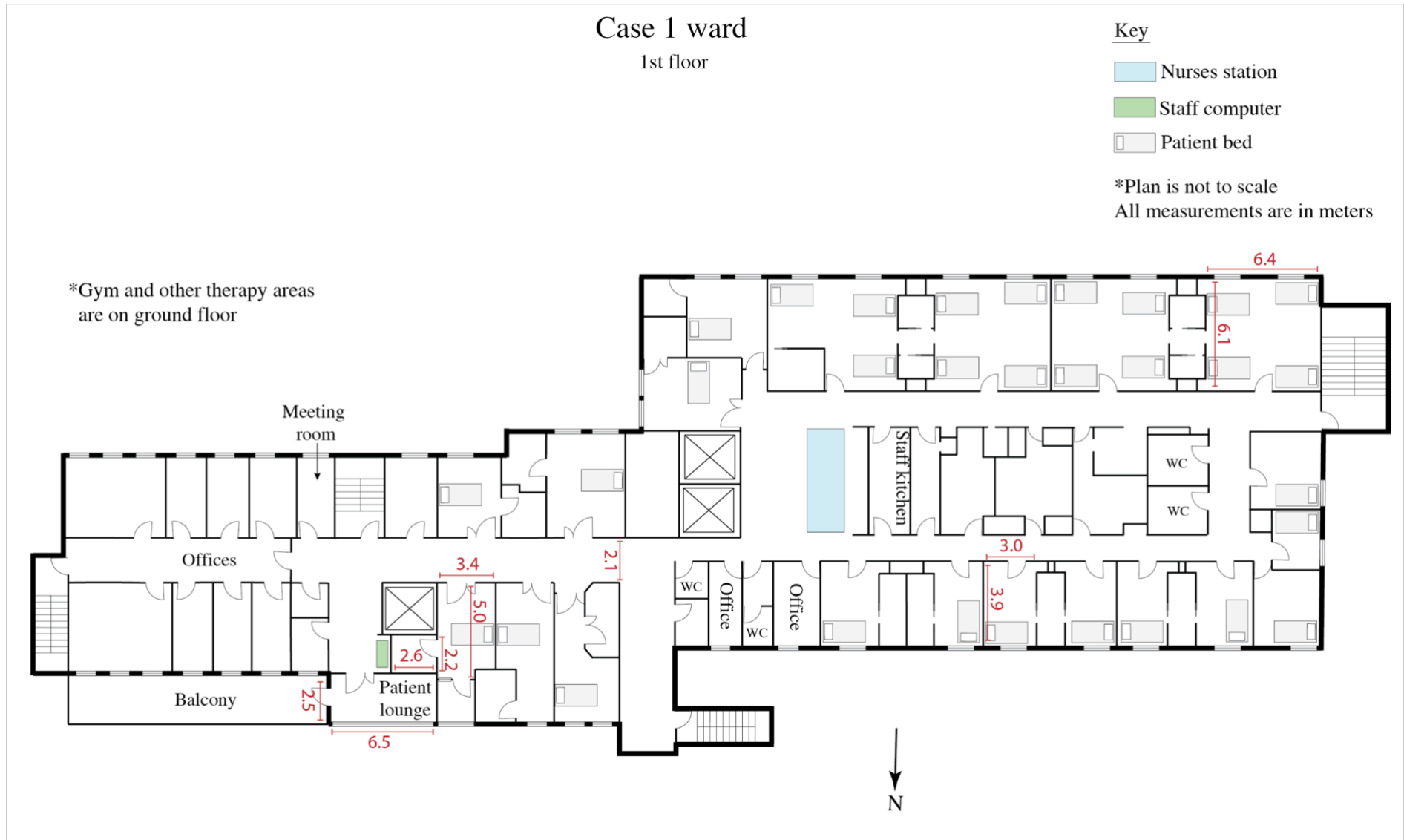


Photograph A12.22 Case 2 therapy garden (4th floor)



Photograph A12.23 Case 2 landscaping outside the hospital (ground floor)

Appendix 13: Floor plans of both cases in Study 3



Case 2 ward 6th floor

Key

 Nurses station

 Staff computer

 Patient bed

*Plan is not to scale

All measurements are in meters

To elevators and 6th floor gym



Appendix 14: Practice versions of the checklists for both cases in Study 3

The practice results of the AEDET Evolution and the ASPECT are compared to the final checklist results for both cases in Table A14.1 and Table A14.2 respectively. The practice results reflect the checklists which were completed before the start of the data collection period for both cases (completed in September 2018 at Case 1 and in October 2018 at Case 2), seven months before the final checklists were completed. Items that didn't change in the second completion of the checklists are in green in Table A14.1. Items that changed by more than or equal to one score are in red. Items with less than or equal to one score difference between the cases are in bold.

Table A14.1 Comparing the practice and final results of the Achieving Excellence Design Evaluation Toolkit at both cases

Item	Case 1 (St George's)		Case 2 (Bendigo)	
	Practice	Final	Practice	Final
Character and innovation	2.2	2.0	5.2	4.8
Form and materials	3.8	3.8	5.8	5.3
Staff and patient environment	2.6	2.7	4.6	4.2
Urban and social integration	4.5	4.5	6.0	5.0
Performance	--	--	--	--
Engineering	--	--	--	--
Construction	--	--	--	--
Use	2.3	3.3	4.4	4.7
Access	2.3	4.4	4.4	5.0
Space	1.7	3.5	4.3	4.7

Minimum score = 1 (virtually no agreement). Maximum score = 6 (virtually total agreement). Items with ≤ 1 score difference between cases are in bold. Scores that didn't change in the final completion of the checklists are in green. Scores that changed by ≥ 1 score in the final completion of the checklists are in red. Items with less than or equal to one score difference between the cases are highlighted in bold.

Table A14.2 Comparing the practice and final results of the Staff and Patient Environment Calibration Toolkit at both cases

Item	Case 1 (St George's)		Case 2 (Bendigo)	
	Practice	Final	Practice	Final
Privacy, company, and dignity	3.8	3.7	5.3	4.8
Views	4.4	4.4	5.4	5.6
Nature and outdoors	3.3	3.3	5.0	4.3
Comfort and control	2.2	2.8	3.7	4.0
Legibility of place	3.5	4.2	4.0	4.5
Interior appearance	3.5	3.4	4.4	4.3
Facilities	2.0	2.3	3.6	3.8
Staff	4.3	3.7	5.7	5.3

Minimum score = 1 (virtually no agreement). Maximum score = 6 (virtually total agreement). Items with ≤ 1 score difference between cases are in bold. Scores that didn't change in the final completion of the checklists are in green. Scores that changed by ≥ 1 score in the final completion of the checklists are in red. Items with less than or equal to one score difference between the cases are highlighted in bold.

A number of scores on the AEDET changed between the two times that the checklist was completed, especially for Case 1. The categories that received similar scores at both cases in the final checklist ('Urban and social integration' and 'Access') did not receive similar scores in the practice checklist. The scores on the ASPECT did not change as much between the two times that the checklists were completed; the majority of scores did change, but all by less than one point. Two of the categories that received similar scores at both cases in the final checklist ('Legibility of place' and 'Interior appearance') also received similar scores in the practice. One category was scored more similarly for the cases in the practice ('Views'), and another scored more similarly in the final ('Nature and the outdoors'),

but scores for these categories were similar between the cases on both the practice and the final versions of the checklists.

Part of the reason that scores on the AEDET changed between practice and final completion is that a number of items were given a rating of ‘unable to score’ when the checklist was first completed at practice. I was however confidently able to answer these items on the final completion of the checklist after spending seven months familiarising herself with the facility and talking with staff. In the practice completion, seven items were marked unable to score at Case 1, and four items at Case 2. An example of an unscored item at both cases was: ‘The design makes appropriate division for gender segregation’, which was in the Space category. Some of the items that could not be completed in Case 1 at practice were easier to complete in Case 2 because, as a new building, everything was uncluttered and the intention of certain aspects of the building was easier to grasp, or it may have been that the checklist was easier to complete at Case 2 because I had already practiced it once at Case 1. Only one item in the ASPECT could not be scored in the practice version of the checklist (both cases): ‘Patients and staff can easily control the temperature’, in the ‘Comfort and control’ section.

Appendix 15: Illustrative quotes from the walk-through semi-structured interviews in Study 3

Theme 1 – Entrapment & escape

Sub-theme	Case 1 quotes	Case 2 quotes
1.1. The environment is restrictive and boring	1.1.20 ““Q: What do you think they could change in the building to help you get out of your room more? A: Put more exit doors.” 2656-01 1.3.28 “I’m bored witless and that’s why I keep doing [crosswords]. That’s about] getting my memory back. So I’m doing all of that and I’m going to the gym and all that cos for me to just sit somewhere for a ... Yeah but for me for me it’s it’s boring. But that’s just because I’m I don’t stay at home at home you know I’m it very rare that I wouldn’t go out during the day. It might be just to walk to down get a bottle of milk or carton of milk, but I wouldn’t take the car, and I’ve got this shopping centre, and then cos I’ve got a post office box then I’d walk over about oh it’d be a couple of k over, so about 4 k over and back um and to get my mail, and I’ll have a coffee and yeah. And then I run into people and we have coffee you know regularly you know. Just doing things. And here when I wasn’t even allowed downstairs.” 2656-02 “[My bedroom] stinks ... because I’m sitting here all day ... It’s not good for the brain. It’s not good for you. You’re talking to nobody. ... I don’t like anything in the room because it’s still locking you up.” 2656-08 1.1.7. “Like everybody that would be here there’d be only one thought in their head just to get out and so to get better and get out. It’s a good place to be when you’re sick but I think when	1.1.18 “you get a bit edgy just looking at four walls most of the day” (2657-10) 1.1.11 “it’s all the same when you’re in here” (2657-04) 1.1.2. “You know just seeing people over and over and over and over and hearing the same things over and over and over and over oh. Just gives you the shits. ... where else is there to bloody go!? Nowhere, is there? That’s what I mean. You’re too enclosed in the place. ... At least once or twice a week if I could walk outside here you know just ... wouldn’t make me feel as if I’m enclosed ... you got to be able to move around the place outside occasionally.” (2657-15) “This room doesn’t [make me feel motivated]. The staff does. Mm. They’re very good. and they’ve been very encouraging too ... I think it’s the people that motivate you most. ... [The ward] doesn’t, what’s the word, innovative or whatever the right word is, it doesn’t encourage me to want to do anything. You know if there was a lot of books then I could go and see what there was to read” 2657-09 2.2.18 “that’s when I find that you can get bored. Is when you can’t just ah get up and go to the toilet or get up and go for a walk. You’ve gotta ring the bell and someone’s gotta be available to take you where you want to go [yeah]. That’s the only time I find that you could get bored.” 2657-06

	you're getting well you don't wanna be here. You know. You wanna be out." 2656-08 "I usually stay [in my bedroom] because there's nothing interesting out there so not really keen to look at, everything is the same. Yeah so that's why I stay in this room" 2656-09 1.1.9. "like a holiday camp. With nothing to do." 2656-10 1.1.5. "[I] set the [bed] alarm off every time I moved, which was very annoying. It woke me up. I was trying to get a comfortable position in bed and this silly machine wouldn't let me. The slightest movement and the staff eruption to see that I'm still in bed. [They] reset the machine and then if I moved off it would go again. So that happened five or six times a night." 2656-10 "[In] this room I feel a bit like I'm stir crazy" 2656-18 1.1.15 "While I'm in this room? I get frightfully bored. Yes what I do is have my meals here, go to the toilet, do my exercises that I'm supposed to do, read the paper, and wait for another day to go by" 2656-19	1.1.16 "every day falls into the next one, every day's Friday yeah it's as if I've been on holidays since I've been in. Every day folds into the next one, you know. You don't get excited cos it's Friday cos you know you've got the weekend coming up. ... it's important to have a sense of anticipation for certain things like the weekend and that but I know I can't get out so I'm stumped you know." 2657-04 1.1.19 "There was a lady in this half and she kept this blind closed all the time (laughs). I didn't see any outdoors. [I felt] sort of closed in you know. Yeah very small and boxy. Small and boxy. Because it's not really a big area is it? This room's is a small room isn't it? At least you got the passage there and you can see people coming and going you know. ... you like to know you're not the only one here (laughs). Don't want to feel isolated from the world do you? ... Just people coming in and saying hello [help me feel connected with the world] .. and here's your tablet or do you want anything or how are you and everything." 2657-02 "I find the [bed]rooms are very good. They're quite roomy ... one lady I had thought the rooms were too small, but I don't find that. I find they're big and nice ... I find this building is very spacious. You don't feel as if you're in a hospital environment really. ... I find there's plenty of cupboard space, wardrobe space, draw space um and quite it's quite roomy to get around. ... [and] I think [the hallways are] lovely. They don't close you in. You know? And you can walk side by side and people can walk past you." 2657-06 1.2.27 "deep down we really hate the place, everyone does. You just wanna get out of here but you also know that you've got to get better before we can." 2657-14
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1.2. Connection, purpose, and change are means of escape	1.2.2. “[I spend a lot of time looking out the bed room window] cos there’s construction going on. It’s changing and it keeps me head going. ... So that’s progress you know, you can see what they’re doing. I call that my TV wall! [laughs] ... Keeps me head level. You know I just go there [to the window] in the morning and see what’s going on ... You just see blokes running around like ants. They’re all doing something. That keeps my head in a good position. I think if I didn’t have that I’d be a little bit more wound up. I could sit there for hours.” 2656-01 1.2.4. “I’ve got the bed that’s right hear near the window or whatever, but eh makes you feel eh that you are not alone lonely sort of thing you know you look out the window and you see the odd cars going past and and the feeling is you go ah I’m not alone, you know there’s a bit of traffic going through here, there’s some people there going through here. You know that sort of thing.” 2656-04 1.2.8. “there’s the room with desks and um and I’ve changed those the they they couldn’t put the chairs underneath the um chairs so I chucked those and put that can get right underneath and it’s great ... so but even if you even you aiming that way or just slight that way it can be better if it’s like that or that way is not exact as best or something you want to be because you want something of interest or something like likable something that you want yeah so R: Do you mean the position of the chair? M: Yes because yes [because if I just sit] anywhere but then I want to look at that the ta ta to me the window. But then it depends on where the blinds are going and then the sun that coming a certain way, but if you look that way, that’s like that’s ok but then if you turn that way it’s better because that way I can see oh there are tr oh cars there they can see people are walking they can see bicycles, yeah but I wouldn’t have been able to seen that but if I had have looked that way or so just things are to me are like	1.2.18 “Just like it’s something to look out on. Whether I sit this particular way and I can look down the street this way um or just even I’ve noticed there’s been movement in a couple of the rooms across where I am and I’m thinking oh ok so it seems like there must be a ward there of some description, not knowing the hospital, but I think oh yeah well there is movement, there is other people [small laugh] around um yeah you just don’t I don’t feel like lonely yeah yeah ... Can see others aren’t that far away really, they probably are, but I think on no they’re okay. They’re doing alright over there and I’m doing alright over here and yeah yeah ... no as I say I’m happy in the room because I can look out at different spots as I say whether it’s across to another ward which I presume it is or down the street this way or yeah there’s just something that I can look at and that just seems to take your mind of whatever else is going on” 2657-03 1.2.19 “I [think] the windows [are] good you could actually see things had a bit of a view ... you don’t feel so isolated I spose, feel more a part of things” 2657-04 1.2.20 “downstairs when me wife comes we go down and have a coffee down on the ground floor [I like going down there] it’s nice [pause] doesn’t make you feel like you’re in hospital ... you see people come and go and you know yeah sort of sort of feeling normal ... you just feel normal, feeling of normalcy ... [you could bring that sense of normalcy into the ward] if you could access some of those services from your bed I suppose like if you wanted coffee or whatever you could just go onto that thing [patient entertainment unit] and order a coffee and have it delivered or whatever. You know what I mean? Yeah that’d be good. [But in the café it’s] a bit of everything I think. The people and the trees and the yeah and the environment itself is quite nice ... One thing they could have down there is ah perhaps like a barbers shop or something so you could have a shave and you know a bit of trim and whatever, and they could have the same
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	interest are observance observance to just things that anything happening it's like" 2656-11 1.3.2. "There's good views from [the gym] ... being able to see off into the distance is wonderful. ... another world. Magic. ... Yeah it's freedom, like when you're locked in a room all the time it's lovely to see the distance, the distance and the hills, even though they're covered in smog. And it's the freedom of the big wide open space." 2656-10 1.2.11. "I look out that window all day. I look out that window all day especially when it's raining. I look out that window and if they pull the blinds down I get 'em to pull them up. ... Well I had that blind up and this um and this blind up so I can look out of both. You know, there's nothing else [to look at]. Nothing else. Just the trees. This tree here wasn't as bushy about three or four weeks ago you could see right through. Now you can't cos it's all bushy." 2656-08 1.2.12. "[The view from the] window outside it's good. Nice view. The same view everyday but sometime you know at least at least I see green I see some green and then the sun or rain anything anything outside .. not only in the hospital. [It] makes a difference. ... Yeah because it's always being kept in the building. I'm always .. I can't really move much so that's the only that you know .. make me feel like you know .. just cheer me up. To see the green tree .. the car and tram I love it. I love to see and I'm thinking about one day I'm gonna go back to get in the tram again. Just the thing to look forward to. And it also make me sort of feel positive sitting watching..." 2656-09 1.2.6. "I suppose in a small way, [the gym] represents my outside world." 2656-03	for women. I mean if people feel better about themselves they're going to get better." 2657-04 1.2.20 "Yes I sit there [at the window in my room] and have breakfast and I look out and watch the people going to work. Or about 5 o'clock I'll sit up to see if it's daylight. They put the blind back I can see the daylight. ... I sit up and have a look see if their lights [in the other hospital windows] are on that gives me an idea it's about 7 o'clock of a morning. Just have a look. ... And if I sit at the window I can see people moving around in there. ... it's just company. You know there's someone there walking around." 2657-08 1.2.21 "You got plenty of daylight coming in [to the seating area in corridor] you can see out. Sort of fills your mind. Occupies your mind. It doesn't .. you know whereas I mean laying in there just doesn't ... I become bored. Sick of watching TV. Q: What is it that occupies your mind about this space? A: Oh it just sort all the truckers going past when they're driving. Yeah and then a helicopter came .. I watched that yesterday that was good. They come down and they take the patient off and take him down the ramp here and then when they came back they flew off like that and then went choo and then straight out there heading .. it's amazing I've never seen a helicopter do that before. ... It fills your mind it keeps your mind active." 2657-12 1.2.26 "Q: So you're looking forward to having the breakfast group? A: Just something different. Get out of the room and see different people." 2657-08 1.2.28 "I get motivated whenever I walk in here .. hospital knowing that if I work hard at improving myself I can go home" 2657-14
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	1.2.13. “I go in the elevator. A lot. Which I enjoy. [inaudible] because it's a change of scenery ... Um particularly the people coming and going. The people coming up in the lift and some going down and some are waiting and um [laughs] they then I always get a cheery smile.” 2656-07 1.2.3. “[I come to the patient lounge] probably once or twice a day. When you get dead spots and you just want to get out of [the bedroom] and you don't know when they strike. [When I] wanna get out [I think] oh I'll do a loop of the ward in [my wheelchair]. Give it a run. ... Something different. Occupy your head. Because what's to occupy your head in here except beige? Oh they've got games everywhere if you want to play that, but I'm not really into that. I don't read any books. Might watch a bit of telly. Trying to keep up with current news.” 2656-01 1.2.15. “I think I'm happy with everything in the gym. It's great. Some of them [the equipment] I haven't been able to use them but I think it's quite good. Yeah and I was I've been imagining that one day I'm gonna do that. I can do that. ... positive feel positive that one day I'm gonna do this and that. ... It's so .. give me ah .. a stronger attitude to work on my body it does help ... It's a big place. It's a big room and there's a lot of equipment. I feel oh this is great mm this is what a gym should be and also the equipment is good too. Help exercise” 2656-09 1.2.25 “Q: is there anything in this room that helps you to feel motivated? A: The steady.” 2656-16 1.1.12 “Well it's a very good gym. It's excellent. It's very large ah I suppose spacious would be the best word for it. You don't feel hemmed in. The staff are very very good and just a pleasant place. Although I hate gyms! [laughs] ... it's so spacious and it has a lot of windows, and you can see out wide wide ... To me	1.2.9. “I think it's great that they've got the ipads ... I like doing wordsearches and I haven't had any interest since having the stroke to do a word search at all. Um and then I saw my grandchild actually do one on the computer, so I made it that was my mission the next day to go down and to see if I could find it or do it whatever, and I did it and yeah” 2657-03
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	it's just spacious, very clean, and lots and lots of windows" 2656-19	
1.3. Nature and the outdoors are means of escape	"I'd like to just go out in the fresh air and go for a walk and you can't do that." 2656-18 1.3.1. "But if you can go anywhere out of the pris prison great to anywhere any where where you have just air and walk and seeds ... Get out of the prison ... don't want to become, what's the word, an institution! That's what I mean! You don't want to be like an institution. You want to be freedom." 2656-11 1.3.3. "When the sun's out you can sit over there [in the outdoor café seating area] or you can sit here [in the therapy garden]. We usually just sit here. This is much better than sitting in the room. It is much better than sitting in that dark room. ... The fresh air. The green grass. The the seats and everything. The open air. The open air that's what I like. Freedom. Everybody likes freedom. That's what I like. ... It's much better here. People can relax and unwind. Filled up with birds. ... I wouldn't change this [therapy garden] because I think this is nice for the people, I think it's more freedom away from the hospital ... And if your family's there. My son and I were coming here a couple of times and just sat here ... And there's been plenty of room upstairs for the ones that wants to buy coffee see there's plenty of room because people come and sit in here. It's nice isn't it? Nice and quiet yeah. It's nice. I like it. ... See they [other patients] like to come out here. They like to come out of the hospital. Yeah and have a bit of freedom. There's nothing better than freedom." 2656-08 1.3.4. "so that's see that's we go out of the cafe ... and so you can walk around there but it's all a bit dark ... you sit there and you know there's no real sun" 2656-02	1.3.17 "being able to look out [of the window] and and sort of see the environment around ya, and look down and you've got gardens and things it makes it more pleasureable. It's not so barren, and it's not institutionalised if you know what I mean" 2657-06 1.3.18 "there's no shade out there at the moment and I wouldn't go out in this heat" 2657-06 1.3.19 "[in garden out front of hospital] I love the outdoors. I don't like indoors. Never have done. ... [I'm] an outdoors person ... It's lovely out here. I mean, um, can sit in the shade. But you just look and there's nature. There's flowers. There's treesen. So they breath the oxygen and um Yep and and it's laid out beautifully." 2657-06 1.3.20 "A few pot plants down the hall might help but then you've gotta find a space for them too .. some palms or something I don't know." 2657-09 1.3.21 "I would enjoy going out. because I'm an outside person (laughs) ... I'm just an outside person. I could say inside, I'm happy in my own home or wherever but that's why I'm happy here because I can see out [the window]. ... But if you're stuck in your room .. I hope I never go to gaol .. I didn't think I could cope with that (laughs)." 2657-09 1.3.22 "it's not stuffy. Yeah it's open. You got plenty of daylight coming in you can see out." 2657-12

1.3.4. “the other day my daughter comes in it was a beautiful day what was it? Sunday, Sunday it might have been. She said come on Dad we’re going for a walk in the courtyard ... So off we went down there and the sun was coming through and it really felt good. It really sort of felt like saying I’m alive, you know? This is still happening outside. You know? It was very satisfying. We were only there for about half an hour, forty minutes sitting there but nah it was yeah it was very good.” 2656-04 1.3.5. “about the room .. it could be more light because when it’s light around around you um around us ah you lighten up ourselves too. If it’s dark it’s dark.” 2656-05 1.3.6. “when you stand here [in the gym looking out window] it is it’s something something .. gives you the idea that you are .. you somewhere with other people or with .. even if you by yourself you can always look at trees [out the window] .. if there are birds out there it’s nice. There are no birds today (laughs) so .. it’s nice to stay in here and just .. I like outdoors. ... I was brought up .. I was brought up um back home we had um a lot of space and we um we were outside all the time ... I think it’s it does continue and sometimes I miss the outdoors if I can’t go out. If the weather doesn’t allow or sickness or whatever ah I miss the outdoor life. ... If you stay in your room it’s depressing.” 2656-05 1.3.7. “And they wanted to take me – there’s a garden out there is there? [looking at therapy garden] Oh that’s were [son] said he’d take me. But it was too hot.” 2656-06 1.3.8. “A bit of greenery instead of the cement but um no. There’s not much I’d I I just like a bit of privacy you know? ... Well I I I’d make it a bit more pleasant you know? I’d .. I’d have some flowers or something like that. Take the hedges out and put the flowers” 2656-08	1.3.23 “I like the .. view [in my bedroom] being up higher [i.e. on a high floor of the building] and .. [pause] and it’s generally nice and sunny here. I like lying in the sun.” 2657-14 1.3.24 “The shape of [the hallways] I just can’t stand the shape of them ... [pause] don’t know just don’t like them ... I dunno I sponse cos we’re boxed in if you know what I mean? ... At least once or twice a week ... If I could walk outside here you know just ... Cos you know it it’d be more more handy for us you know just be getting out and around ... Wouldn’t wouldn’t make me feel as if I’m enclosed if you know what I mean ... I I just can’t I sponse it’s claus claustrophobic in one way but it’s too restrictive if you know what I mean ... [I don’t do any] physical activity at all ... I sponse I’m more of a country boy than anything ... As I said you got to be able to move around the place outside occasionally. It’s too enclosed.” 2657-15 1.3.25 “the weather’s been pretty dismal so it keeps me inside.” 2657-16 1.3.26 “it’s good to be outside, out of this place. Lifts the spirits a bit. Like I said it’s like a jail up here sometimes so it feels good to get out of here.” 2657-16 1.3.27 “just peaceful being able to look at the mountains [out the window]. Makes you wanna go out there. Gives you a bit of inspiration to wanna go outside. Wanna go and do something.” 2657-16 1.3.15. “I don’t think I’m allowed to yeah [but if I could go anywhere I’d] probably to get outside maybe. Yep, but on the same token I’m too scared in case they said and I’m too scared to go on my own anyway, but um yeah that might be the next venture that I just go out say for an afternoon. Even if it was just to sit on the grass. If there’s grass there, I don’t know if coming
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	1.3.9. “even if they had it in pots the plants inside you know that’d be ok ... I don’t know and they could put them in the rooms if you wanted to ... Brighten the place. Nothing much here is there? There’s nothing much to look at.” 2656-08 1.3.11. “well there where they’ve got that green felt part near the café the café the café and um and we just sit out where the table ah the benches are and um and just and I I’m interest anything in that area. For me, it’s like when I find the ah I say with J that I like pull of the ah leaf and then I’ll smell that and you know scrinch it what’s the word? R: crush? M: Oh you crush it. And sm smell it and then and I’m also interest the weeds in that are ok pull out some wo oh of those, just 2 or 3 or something like that and some of the flowers have been picked up for the weeds and stuff like that and I was walking through the grass finding the seeds that get caught in their socks and stuff [like that]. And just sort of anything of interest ... Because there are well because the because you can scrunch whatever these [crushes leaf in hand] and smell whatever the the um scrunch what’s that word I used? R: Scrunch? Or crush? And you can sniff it. M: Yeah at least you can R: Oh that smells great! M: Yeah so that it’s just something to do that’s all. I didn’t do that one, just try anyone of these. R: Mmm it’s a good one. Eucalyptus. M: Yeah. It’s better than not seeing it. R: Yeah yeah. Yeah. M: It’s just a way in the breeze and in the sun. Somewhere to sit and talk about whatever. Chit chats. R: Yes. M: Nothing really but ah. [pause] and so [pause] R: it’s a nice place to come M: And the wattle that’s been taken out. That’s what’s the word for it um.. no one planted it it just R: oh it seeded itself M: yes, right there R: self-seeded M: Yes I can try the leaf that one. It won’t smell anything but that one I’ll try. It’s better than not doing something that’s all. Than just sitting in a prison. But that one I think doesn’t smell any one R: It doesn’t? Let’s see. Mmm oh no I don’t think so, I can just smell the eucalyptus on your hands. ... Thanks for the sun” 2656-10	in here I saw or grass or not. Um yeah. So that’s probably my next aim yeah is just to get out. Mmm Probably get my bearings more so than anything yeah yeah” 2657-03 1.3.16 “[If I could change anything about my bedroom I’d put in] A few skylights a bit of natural light instead of what they currently got ... it’s all artificial light ... And the only natural light comes through there [window] and that doesn’t go very far.” 2657-04
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	1.3.12. “Oh I like I like sitting outside. I like being outside anyway right. Just being outside having a coffee or a cup of tea. Just sitting outside and I’ll feel better than being inside.” 2656-15 1.3.13 “found like if I sit sat kind of on that area [looking out the window in bedroom] I didn’t see the building and the this area over there which I used to say it was like Tuscany because it was um this tall pen pen pencil pines and gardens and and the um that sort of at dusk it was just beautiful and I’d sit there and it was just perfect. And sometimes I would just look at the clouds .. that one [new room] really hasn’t got a great view.” 2656-18 1.3.14. “It’s pretty stark [in the café outdoor seating area]. But that doesn’t really matter. Q: Mmm what do you mean by stark? A: Oh well the tables are very sort of ah they’re grey and it’s not I can’t really think of the right words ah but it’s nice to be able to go outside and sit at the table there. The sun and the breeze Q: mhm and you said that it feels a bit stark but that doesn’t really matter A: Well it’s grey Q: Yeah. But you said that it doesn’t really matter that it feels stark. So why doesn’t it matter A: cos I don’t care Q: Yeah so what’s more important than A: A good cup of coffee and the sun Q: aha yeah A: And the ah being out in the fresh air.” 2656-19	
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Theme 2 - Power, dependency, and identity in an institutional environment

Sub-theme	Case 1 quotes	Case 2 quotes
2.1. Surveillance	2.1.1. “You’re in the colosseum and that’s where you are. ... You learn that as you go along, you gotta change your thinking when you’re in here.” (2656-01) 2.1.2 “I feel cooped up. When you’re told you can’t do something and you’re 72! ... I’ve always been a very independent person. I do what I want to do when I want to.” (2656-12) 2.1.3 “they don’t want me to leave the hospital because they feel it’s too dangerous for these people in charge and um so I think I’m like forever stuck in this hell hole. ... They think I’m gonna .. I’m falling all over and I’m not ah and I haven’t been blessed with a .. you may go, you may leave now [permission] ... It’s like they always think I’m gonna make them um get get news report that says ah ... they made me fall or I made myself fall” 2656-20 2.1.9 “[I] sneak out. Don’t you tell anyone ... [I] just sit down there in the sun ... I actually walked across the road the other day. Traffic’s holding off [inaudible] and then a truck came bolting up but luckily it stopped and as I was walking across the road[inaudible] it’s very obvious I’m a patient dressed like this. ... [I go outside to] just get out of all this you know there’s too much watching. It’s like being in school ... I can’t get out of here without she’s got to sign me out and sign me back in. No that’s the doctor being [inaudible] ... [sneaking outside is] a release. No body around to tell you what to do. You can’t go far unless you’re taken. And to make sure I can’t go far [name]’s got my wallet. But I’ve got a legacy taxi card. So all I’ve got to do is ring the taxi and they’ll come and pick me up and get to the other end and then I pay him.” 2656-12	2.1.5 “It’s very depressing [in the hospital]. I just find it depressing. I find it makes my mood depressed. ... It feels a bit like a jail. Just the atmosphere and that. And the colour scheme. It needs a bit more colour. Make it a bit more lively. I don’t know red, blue, green. I don’t know .. the staff rushing around doing their thing [makes the atmosphere feel like jail]. Patients just walking round with their heads down. Not very cheery. Everyone seems to be down in the dumps a lot. That’s fair enough I suppose nothing to feel happy about in here. I get where they’re coming from.” 2657-16 2.1.6 “it’s like a jail up here sometimes so it feels good to get out of here. All the rules they give me that I gotta live by. I feel a bit singled out sometimes so I don’t know you giving anybody else these rules or is it just me. ... It makes me angry and depressed. Cos I hate being locked up in hospital and I don’t see why I should have to be locked up. I’ve done nothing wrong. I haven’t committed any crimes. I just had a stroke which was out of my control. It just happened to me. And I get locked in here like I’ve done something wrong.” 2657-16 2.1.7 “I really gotta behave myself cos I didn’t behave myself there very well so they said if I don’t behave myself they won’t [discharge me]. So now I gotta pull my head in and really behave myself. Otherwise I won’t get home which is a real bastard. It should go on your health and stuff .. if you’re not healthy enough to go home, but I wanna go home.” 2657-16 2.1.8 “I tell you what, it’s like jail ... That’s exactly what it’s like. I’ve never been locked up before in me life and I don’t intend in being locked up but I reckon it is exactly like jail would be like ... Everyone’s keeping their eye on everyone no matter

	2.1.29 “I don’t think anybody [i.e., any patient] in here wants power. They want respect. There’s a big difference.” 2656-01	what. ... What’s wrong with me going [outside the ward] by meself though? That’s what gives me the shits. It gives me the shits ... I shouldn’t have to ask! That’s what gives me the shits.” 2657-15 2.1.27 “they have security ... That makes me feel a little bit safe knowing there’s security there ... I talk to them quite a bit when they’re around. I get along with them well. They good blokes. ... he used to hang out outside my room a little bit. ... I made some comments about the nurses and the doctors so they made security stand outside my door or sit outside my doors to make sure I wasn’t going to hurt any body. Yeah they had three of them there for a little bit. I don’t know why they need three security guards for a bloke with one arm and one leg. But anyway they can do what they wanna do. They were earning money for doing nothing I wasn’t causing any trouble they were just sitting in chairs. They probably made good money for sitting down all day so there you go. And we all got along well. Have a little talk and a laugh every day. ... I knew nothing was going to happen to me while they were outside my door”2657-16
2.2. Relying on the environment for safety and well-being	2.2.7 “See the colour of those doors? Beige. The whole place is beige. ... It it just flattens you. ... Beige. It’s just that’s all it is ... There’s nothing out there to amuse you it’s just all beige.” 2656-01 2.1.15 “that’s why I asked if I can walk up and down the stairs [because the lifts break down]. But no I’m not allowed to do that. Yeah. ... I just thought it’s only, like to go down to the, it’s one floor down you know, two floors down sort of thing. And they said no! And I sort of understand because a couple of the ah a couple of the stairs are quite st st s steep. And I said look I I’ve gone through a lot of that but it you know when I I went with H	2.2.12 “Just add some more colour. Maybe go to the local pre-school and get some paintings from the kids there and put them on the walls. I think the elderly people would like it too. My dad’s seems to like when my nephews and nieces do pictures for him. He puts them straight up on the wall and he’s 80. He likes the colour and just the abstractness of them .. you don’t really know what it is. It’s all over the place but they look good.” 2657-16 2.2.13 “There’s usually pretty good music going on there [in the gym] so you’re motivated or I take my own music. I usually listen to music I like [in my own room so I feel motivated], ... Something to get you a bit more inspired maybe the music they

	[name of OT] once, I walked down and walked up, and I she said and I I said look I hold on to the the [handrail]. ... I asked if I could go to the stairs, “look we’re sorry, you can’t” you know “but this is the reason” and I go oh that’s fine thank you. And you know I think they’re all surprised that all I need to know is why.” 2656-02 2.2.8 “got no pictures [in the bedroom] or ... they could have put something something light up the place but who knows why they can’t do it. ... Um a nice picture like the one outside [in the hallway]. Other pictures probably .. even um children’s um paintings” 2656-05 2.2.41 “It would be good if you could walk around but you can’t because they’re all too busy.” 2656-08 2.2.38 “[I want] decent television [in my bedroom]. With something on. I don’t wanna watch cricket. ... Television in .. they gotta better picture than we’ve got. [referring to TV on wall by chairs on ground floor]. On our TV we haven’t got any choice only cricket. Cricket .. got no videos .. nothing .. cricket. Old people don’t like cricket.” 2656-08 2.2.47 “It’s only like one time we had experience with the .. cos I lost the buzzer and then there wasn’t anyone coming the whole night and ah .. and I need to go for a pan or get a bed pan or something there was no one come and then eventually and take like the whole night and now change they coming round every 15 minutes or I mean a half an hour ... that’s the thing that should be if you don’t hear anything from the patient I think you should you know keep your eyes on and go in and check them re.. whether anything went wrong or anything right that you can look on now so it can’t be right the whole night there’s not going to call anyone or the whole day is no one come. It’s not right. ... sometime you might need something that you just can’t reach	play .. they could play bit more inspirational music [in the gym]” 2657-16 2.2.16 “I didn’t go for a walk because I have to walk with a nurse you know. Limiting yeah.” 2657-02 “[The patient entertainment unit] could be a little bit more um updated like if they had Netflix or something on there if you could watch something like a series or something ... [Whether it’s easy to use is] a little bit on and off, hit and miss, needs to be a bit simpler. I don’t know how older people would get on trying to use it you know” 2656-04 2.2.22 “Knowing that the nurses are just out the front if something goes wrong, or just a buzzer away [makes me feel safe].” 2657-14 2.2.30 “I’m very pleased with it but I like the sides of the bed I pull ‘em up cos I’m frightened I’ll fall out. Yeah I pull them up.” 2657-08 2.2.31 [daughter (D) of patient speaking – the patient (A) also agreed with what she was saying] “I mean I think well although they’re clean they’re very sterile. There’s .. like I brought flowers that got thrown away. There’s no .. there’s just very calm colours but I think it would nice to have some art work on the walls. Sort of just a bit of stimulant .. cos you can watch TV but I think sometimes you might just like something like a bright picture or something to look at and just some stimulant in here. A: Well when you first came in the lift when I was downstairs I see pictures D: Yeah in the hallway A: Yeah in the hallway. You see you could do it in the [bed]room. Which would be a help for patients. D: just a bit more stimulant I think. Yeah. ... A: Well I’ve only got the thing there to look at [hospital chart on wall]. ... D: but I think having a bit of like colour. You know just dunno
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	these things and it happened because it's dropped or yeah and I feel you know regular regularly check up it's safe it's safe here and I'm safe." 2656-09 "Yeah so I loved about having my my for me about having my iPhone. ... I'm all [laughs] always all the time on to um I can be on ah I ah internet internet. So that's one great thing for um. So I can look at internet. And also phoning and ah text and internet. And so and I ideally would be like like deck sorry top desk or whatever the word it. Desk top. That's be great and then you'd be able to have a a an internet commuter" 2656-11 "I quite like [the gym] it being light and airy and a big space. ... it's better than being gloomy and miserable ... At home we've got lots of windows. And you know it's a very light house. It just sort of feels familiar and there's views out of the windows. At home we've got views out of the windows. That's one of the best things about home. So that's why it's a nice feeling and we've got a timber floor at home and it's a timber floor [in the gym]" 2656-16 2.2.9 "There's a an SBS channel called chill which has music to unwind. You're meant to .. when you get home from work you turn it on and relax so I often listen to SBS Chill [on my headphones in my bedroom]. ... it has a certain beat that makes you feel relaxed. I find it I find you know very soft music soothing." 2656-16 2.2.48 "Yes well I like to feel as if I have still little bit of control. Q: Mm. Ahm yeah. A: But it's very limited I know. Q: Well are there other things that help you feel like you have .. you know .. help you utilize the control you do have that you've noticed? A: Say that again. Q: Are there other things that help you to use .. make the most of the control that you do have? A: Yes yes the bell I won't go anywhere without it. Q: Ah the bell yes. Yeah,	just a picture or something it it takes away the starkness at times. It can just give you that warmth. It makes you feel a little bit more better. Think like even like an outside picture, if you can't get to the window, if they had something like with an outside .. flowers or something." 2657-01 2.2.32 "Oh I think that [the bedroom is] pretty nice because it's got red and gold. It's bright isn't it? It's got the grey and everything and it's got everything in it and all the equipment you know is in it. It's modern and .. don't know what words to use but it's just a nice room. ... I suppose it's reassuring in a way .. Only because it's modern you feel safer in it .. it's got everything in it that you need. All that you can have in this present time. ... [the colours are] bright and cheerful and they brighten up the grey and the brown. They all just sort of blends in nice doesn't it? ... It's just safe. You know. You don't have any ill feelings or anything. Yes it's good in that way." 2657-02 2.2.33 "I like it because as you say it's everything still seems all fresh and it's all new um doesn't look weather in any way at the moment um [pause] Yeah. ... because I think that also can affect your the mood that you might be in. Yeah like well when things are like fresh clean and that you just think oh yeah I feel good in myself, whereas if it's dull and and doesn't look overly great you think oh well you just tend to go down that dull kind of track." 2657-03 2.2.34 "I think the equipment they've got and the set ups they've got where the rehab and the gym and the pool and all that to know that they've got really good stuff, that's fairly motivating you know. I mean if you walked in and everything was dirty and rotten and falling apart and that that wouldn't be inspirational or motivating, but everything seems to be pretty well state of the art you know which is good ... like they know what they're doing" 2657-04
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	yeah. A: And to me it's like at the moment, it's very important with that bell. Try not to use it but at least it's there and I don't feel .. and I'm not saying, alone is not the word I don't know the word but if it's there I feel as if I have control. Q: Yeah. Yeah so are you saying alone is not the word? Do you mean because you don't feel lonely is that right? A: No I don't feel lonely. I just feel connection." 2656-17 2.2.49 "Yes [I feel safe]. Because if I don't I know this [buzzer] is here. ... Yes I don't without that I feel I'm cut off. This is my real friend. ... Whether four walls make you feel safe I suppose they do but this is a real thing in my life. That I don't feel as though I'm alone." 2656-17 2.2.11 "Just make it look a bit .. not so stark. Paint [the walls] a bit (laughs) m maybe some plants and um some flo flow [flowers]. Yeah and photos. Especially I think in in the the ro [bed]rooms." 2656-18 "I noticed the other day there was a day in in the ward that there was some music on. And I thought they should do that through the day. Not all the day but ... Mm you'd think actually they might always have some music on." 2656-18	2.2.35 "It is a very nice room it's kept very clean. It's beautifully kept. I'm amazed at how clean they keep this place you know. ... I I'm amazed at how clean they keep it with the amount of people going through. The toilets are kept very well. That's something I'm very fussy about (laughs). ... I'm really amazed when I walk through anywhere, this place is so clean, it is remarkably clean. ... [It makes me feel] confidence in the place. You think if they have toilets then they'll have a clean kitchen. Things like that passes through your mind." 2657-09 2.2.36 "It's a very pleasant room. It has a good view outside. ... it's not an interesting room. ... It's a very disinteresting room in itself. It's got this beautiful view which overshadows everything else. ... I find that end room boring with the grey. I'm not a great believer in grey paint ... but if you put something like that on it it takes it away ... I thought about that one day but I don't know what I thought now (laughs) um something um well there are blue and greys outside .. maybe a pastel colour .. with you know a a light ceiling to reflect ... No [the grey is] good actually. You can be in a hospital and getting a lot of use. You need to account for all those extra feet that come through haven't you. ... I don't like greys as a rule but in here I can appreciate because they go with anything." 2657-09 2.2.37 "I like the way it looks. ... It's clean. It's clean, it's healthy. You know looks new. All new. Yeah. The colour coordination is good .. grey and white. Yeah no worries. Lighting's good. The lightings good. Yeah they did a good job of that. They made sure what's that when it's night that the lighting's good ... Yeah. It's pretty good. Colourful." 2657-12 "[When I'm in my room I] just watch TV and listen to music. Get on my phone, text people. Call people. ... I'm trying to get my laptop repaired at the moment. I want to get some memory type
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		games to put on it so I can help um build up my memory again. Work on me memory. But um I forgot what's my passcode to get into it so I've got to pay someone to get someone to get pass the passcode and put a new one in." 2657-16 2.3.13 "Because of the way the bed is originally the mattress which has been changed which I appreciated very, very, very much don't forget that bit that's very important and the pillows are good. And I said the linens are always lovely and everything's very clean. Um I think it's probably just me I'm very restless .. being away from home I'm extremely restless and you don't actually have what .. I can remember as a child being in hospital, the nurses would go past very quietly make sure you were alright and you were settled. You don't have any of that in the adult places apparently now but it's reassuring if somebody says are you alright love and you say yes thanks. Especially if you're not well. When I'm terribly restless I get so tangled up I have to press the thing [nurse buzzer] to get someone to help" 2657-09
2.3. Ownership of the environment	2.3.2 "you go down to the reception area you got plants and cards and that to brighten it. But we got beige." 2656-01 2.1.22 "you know first they didn't explain it anything to me, and that's the other thing for me, if you tell me even if I think it's silly I'll just go oh yeah well that's what you have to do. ... they said well you certainly can't go outside, this is Melbourne, you know, and you live in Canberra. [laughs] And that really ... so I said well in actual fact I bet I could tell you more about this area than you can. And so after that they've been quite nice to me. And I and if they'd said there's a Victorian government rule that ah you've got to have somebody with you because if anything happened I would have gone, they would only have had to gone there's a rule and I would have been. But but I think I don't know why they were trying to tell me something that that	2.3.19 "I do feel this is my room because I'm paying for it medical-wise" 2657-01 2.3.7 "they swapped them [my bed] over. The nurses on last night was .. one of them put this bed in here for some unknown reason .. the other one [bed] went out. ... I don't know why but the nurse that was on before her later night insisted the other one [bed] come in and she got that ah water bed mattress for me" 2657-10 2.3.8 "I can't take you down [to the therapy garden] cos it's um you've gotta have someone to unlock the door" 2657-06 2.3.10 "As for the set up [of the bed room] I can't comment on that because all I do is say will you please do this, will you please

	probably was right, but if they'd only just said well this is the rule, I would have gone that's alright I don't need anything else." 2656-02 "I've come to realise that having a stroke is more than just losing muscle power; it seems to alter one's relationship with the world ... my relationship with the world I had taken for granted and all of a sudden was no longer there. ... In the past I have been able to get out of bed, go anywhere in the house, wherever I want when I want, but I can't do that now." 2656-03 2.3.17 "I think people will come and go and this is the room, this is the way the hospital they've got it set up to their ah to best advantage you know. Patients coming in and out." 2656-04 2.3.18 "It's amazing you know how people once you're in hospital where they put your change of clothes that's where you classify as your home. It's you know, funny thing, but that's how it is. At least for me that's how I feel and I think a lot of other patients you know yeah home is where you put your slippers under the bed that's home aw yeah. Ah yeah but ah you know it's a bit of a sometimes it is a bit of a hard pill to swallow it's not easy." 2656-04 2.3.21 "Access to everywhere is pretty good. ... People are pretty much welcome to walk wherever they want and if I want to go down to the gym I can" 2656-04 2.1.18 "I wasn't allowed to go [to the ward lounge] by myself I wasn't .. I am now (laughs) but I wasn't ... I don't know if um if they've got facilities here ah .. to go out of the room and meet other people .. I don't know if they've got the facilities or if they're allowed to do that ... the doctor or could be a nurse told me that I'm allowed to walk around by myself cos he said now you can walk you can go up around here" 2656-05	get me that so it doesn't give you a real feel of the room, but from where I am I'm very happy." 2656-7 2.3.11 "So I just asked C[name of partner] if she'd get the kids to do them and so she sat the kids down and got them to do some pictures. Which is good. I had a couple more on me door but I don't know where they're gone .. from R[name of son]. R[name of son] made me a couple of big pictures. [They were on] this side of the door so when the door was open and I used to come down the hallway and I knew which room was mine straightaway. Now I have a bit of trouble. I gotta wait til I get to the number and see the number. ... I don't know someone just took them down. I was told not to put them on the walls cos it can peel the paint off the wall so I put em on the door cos the door is powder coated. The paint's not gonna go. ... Sometimes they fold em up and put them on the red shelves." 2657-16 2.3.23 "I can't reach it that side cos I'm left handed. And if it was there I could reach across and I said to the nurse "who shifted it?" .. she said "I did". ... I dunno [why they moved it]. I went to get some tissues and I couldn't reach over but never mind. It could be worse things." 2657-08 2.3.22 "not every picture suits a person. So that's why I think that [having a space for patients to put their own pictures] is good because you can put up something like that of your family. Or your dog (laughs) or something .. so you can just have a little thing slip up there where you can put a little envelope type thing. And that's a kind of vision where you want to go to. You know what I mean? ... Whereas a picture of a rose or something might be pretty but a rose is a rose as they say. ... You can put a picture of a horse up maybe a woman wouldn't like it, if you put a picture of a pussy cat up there maybe a man wouldn't like it so .. what can you do?" 2657-09
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	2.3.15 “Everything’s perfect [in the gym] for what I’ve gotta do.” 2657-08 “I’ve um never taken any notice [of the building]. I never take in any notice. I just wanna get better. I don’t take any notice of things. I don’t even look at them. ... So I don’t wanna go anywhere else [in the building]. I wanna go home and when I finish this hospital .. I don’t want to see another one. And I’m sure the hospital and the doctors would understand that because that would mean they’ve done their duty and I’ve done mine my duty. ... Just to get out. Get out. What is there to notice? The curtains. The doors. The young man walking up and down. What do you .. what do you have? There’s nothing here. But what can you do? Nothing. Can you?” 2656-08 2.1.28 “also it’ll be OT soon that’s why. I’m sitting waiting for them cos I don’t want people to wait for me.” 2656-09 2.1.19 “[the lounge room] doesn’t look well used though. Maybe cos no one knows it’s here. Probably only used by staff. ... the staff are keeping to themselves maybe. But for people like who are not allowed to leave the room, not allowed to walk, they would keep it a secret. They were paranoid about me even putting one foot on the ground cos I might fall.” 2656-10 2.3.25 “come out and give me a lecture and tell me I’m a naughty person like this .. when you’ve got the ah night extra large bag on for the urine and you get your foot tangled up in the in the long plastic tube and you buzz them .. he’ll come out and say um now you’ve got to remember this is mine not yours ... we’re the ones who get to play with the bags .. we’ll come and empty them they need emptying, it’s not yours to play with. You keep playing with it and get tangled up in it” 2656-16	2.3.29 “it feels a little bit more boring on the weekend. Cos I’m used to doing something at the weekend. Catching up with me mates, having a beer, going for a walk and doing something. Now there’s nothing to do on the weekend here. There’s no activities or nothing. I saw on me bloody poster thing over there .. the calendar said weekend activities and programs but I have not been told about one. No one comes around and tells me anything. There’s one bloke’s come around one time and offered me to play bingo. I didn’t really want to play bingo so I said no thanks. ... I want something a bit more sporty, more .. a bit more fun than bingo. Only old ladies and old men play bingo. There is a lot of old ladies and old men in here so I understand why they probably play bingo. ... [they need] some activities for the youth. The younger generation of people.” 2657-16
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	2.1.34 “I don’t know I probably can just go for a walk but I don’t know and nobody sort of said that you were allowed to go out.” 2656-18 2.3.1 “I don’t care [about going outside] because I’m just passing time in here waiting to get out. Because surely it is going to happen before too long and if it doesn’t then I’m going to despair (laughs) that would be difficult ... I do like being out in the sun ... [but] I think I will be home within a few weeks. So I’ll leave all those joys for that” 2656-19	
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Theme 3 - The rehabilitation facility is a shared space

Sub-theme	Case 1 quotes	Case 2 quotes
3.1. Compromise, privacy, and peer support in the bedrooms	“hear that door? It starts at 5 o’clock in the morning. The staff door. It just wakes you up. I told ‘em about it but they can’t do anything – it’s a structural thing. They put signs on roads so trucks don’t use engine brakes yet you’ve got a bloody door like that right next to the bedroom common... It’s just dumb ... You can’t [sleep]! You’re waiting for the next person to bang it because it could be loud or it could be reasonable and you don’t know which one you’re going to get so you’re atuned to it and I’ve been here long enough to be tuned to the bloody thing.” 2656-01 – single-bed room, ensuite “a lot of people come to these two [bathrooms opposite my bedroom] because apparently they’re cleaner than some of the others ... I save up until I go to the gym or the um down to the occupational kitchen [laughs]. ... sometimes it’s almost like they’re lined up to get into the shower. ... during the day they often congregate here ... just cos the toilets. But I’ve never said oh will you hurry on or anything like that. But then at night time I can [hear] people I’m not sure in which room and they’re having these deep and meaningful discussions and I think where are you during the day?! But again I wouldn’t go and knock on their door or anything like that I reckon. But it’s only in later in the evening, you know sort of 7 or 8, and their room’s over there and I can hear so I just shut the door. R: So when you shut the door you can’t hear them? A: Oh yes you can.” 2656-02 – single-bed room, shared bathroom “I am puzzled by the sounds I can hear of other patients ... there’s one particular man, I become accustomed to him ... he has a lot to say ... he’s quite familiar now ... yes, it is okay ... I have trouble getting to sleep sometimes, I am not so sure why that is, perhaps distraction ... I think mostly things around me ...	“I hear the door always swinging out shut because as they going in and out all day long and then at nighttime all night. ... They go in there, like take sheets and the towels and things like out so that door swings.” 2657-01 – single-bed room, ensuite “she’s been a good neighbour friend. ... The bathroom’s good, and so close. And you haven’t got competition for the loo. ... I don’t mind [sharing a room]. Yeah with people like her is good. Yeah her family have been nice and chatted to me and everything.” 2657-02 – two-bed room “the bell (laughs). Must drive the nurses nuts.” 2657-02 – two-bed room “I think the like the rooms are good. Um we still have our privacy with the curtains. ... I find it hard to have a conversation actually in the room. ... normally [my roommate’s] TV’s on very loud. I can’t hear what people are saying. Um in turn I guess I get a little but frustrated with that. Um can’t hear if the phone’s is on vibrate I can’t hear if that’s going and basically I can’t even hear my own TV. ... But I do like it from what I’ve seen, only having 2 or 1 in each room. I think it’s a fantastic idea. Not like having 4 in a room. ... since I’ve been able to walk better I’ve gone and I head to this area here [lounge nook in hallway] – might only be 10 minutes but just to get a breather out of the room – I head down to that bottom room [lounge room] and just have a look at the newspaper or just watch someone walk by ... I normally just pop up there to read the newspaper, or or if normally if my family come that’s we head up there because it just seems easier with the children. ... I think it’s the patient [in the bed] next door that just affects me! ... it’s just frustration because I think, ‘come on like I’m not making a sound’ you know, ‘give me a break just for a

	sounds that come through the door” 2656-03 – single-bed room, ensuite “Q: I want to ask you as well about what it’s like being in here in a shared room with other patients? A: oh don’t take much notice really ... You make do. You’re in here with two other people. ... You don’t worry about it. They do their thing and you do your thing. [Name of roommate] and me we sort of become a bit more friendly. ... he says in the morning ‘good morning your majesty’ I say ‘ah yes good morning your highness’ and we have a bit of a joke, bit of a laugh. Yeah and as it turned out he lives in [name of suburb] yeah and I said oh yeah how we go! They’ve found all of us and put all of us together! Yeah he lives in [suburb] and Hungarian by birth. From Hungary. We both come from Europe, somewhere in Europe, you’re from Hungary I’m from Italy ... you have a bit of a chit chat and stuff like that. But ah nothing in ah in depth you know” 2656-04 – three-bed room “my room .. I’m happy. I’m very happy with the four ladies. We can talk during the night .. we can laugh (laughs) we don’t cry. ... we always try to find ways to to come close ... I don’t know if they allow hah .. if the other people allow us to ah get into into conversation ... I always always keep them tight ... get into conversation. ... I’m happy with them. ... I prefer to be with other people. Um it could be a bit better if there were just two [instead of four in the room] but ... I don’t want to be by myself. ... with two it’s always less talky. ... Less noise yeah. ... I’m not talking too much (laughs). So of course but I’ve got somebody there who talks a lot ... Q: I notice that you hold your um tv [speaker] to your ear, the the tv sound to your ear. A: Yeah. We got ah ah I’ve got it lowered. I don’t want to disturb the other people too much ... Q: Yep. Yep. Have you put any of your your own things around your bed? No. Why not? A:.. not enough room. Not enough room to put stuff up. And ah .. and we have to respect other people, is another thing, because if I put something	minute’ and yeah. But actually, it was yesterday I spoke to the nurse about it. I just said um oh come on like this is just not called for really, and I said and I shouldn’t be speaking out but I said I’m going to because I don’t know how long that I’m going to be in here for, and I don’t want this to be escalating any higher than what it is, so can you please, can she please turn her TV down? Like I didn’t think that was a huge thing to ask, anyway, they turned it down, and it’s been gone ever since. ... she’s got problems whatever they may be, I don’t know, um so yeah [pause] yeah I just sort of didn’t want to step out and say oh rar rar rar [complaining] but I think oh come on like fair’s fair and it seemed like yesterday every time I went to have a lie down like she would bang her cup on the bench! Oh no please. And it’s like she knew that I was having a rest, because I pull the curtains all the time, and it was like every 2 minutes ‘bang’ on the desk. ‘Oh man oh man’ I’m thinking, ‘no she doesn’t want me to sleep’. So I just got up and thought oh well, I’m not going to have a fight fight over it or anything you know I’ll just get up and yeah come [to the lounge nook in hallway]. ... she does look at me a lot. Um you know how you sense someone looking at you and every time I looked over she was looking I just think when I close the curtains well, she can look as much as she likes because she can’t see me [laughs] ... you can’t have a conversation with her because she’s deaf, and I just think oh well, yep, we don’t need to look at each other because we’re not having a conversation. We haven’t, haven’t had one since I’ve been in there. Um yeah and then on the same token I don’t want her to see that I’m, that I have a cranky look on my face because she’s banging that damn cup or whatever it may be [laughs] And I just think oh pull the curtains and she doesn’t have to look at me and I don’t have to look at her! Not that it worries me to look at her, but I just oh well it’s just easier.” 2657-03 – two-bed room “there’s nothing wrong with the room except there’s four of us in here and it gets very busy, especially at night .. buzzers going off
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	on and doesn't suit the other person I don't want to disturb her. ... otherwise it's enough room. Plenty big room um it's got those curtains to help people .. lying down .. or .. of .. Q: a bit of privacy? A: Yeah." 2656-05 – four-bed room "I do get on well with people in general. ... I didn't think I'd like the company. But um well actually I was offered a private room yesterday ... but I said I think I'd just look a snob now, I couldn't leave these people ... And they enjoy the company. ... And the lady next to me there [name of roommate 1] I mean ah we know of people. She comes from up north and so do I. Where we grew up as kids you know. And we ah a lot of the same background as country people. ... well and [roommate 2] put her hand on me at one stage and said you know, she said I've got a stash of pills at home when it gets too much. And I did, I thought, I've gotta share that. So I just whispered to one of the staff." 2656-06 – four-bed room "I don't always want to get away from [the sounds outside my bedroom]. ... because they let me know someone's around. (laughs) ... And there are happy sounds, there are people talking and laughing" 2656-07 – single-bed room, ensuite "Yeah I feel safe. There's nothing here .. nothing frightens me in the hospital. ... I don't know whether [it's the room on] this side [or] this side or what - the swearing! ... I don't look in there so I don't know who's in there or anything but just before you come they were swearing bad. Yes so you don't you don't expect that ... I've been in hospitals where young people have really screamed and gone off and it didn't worry me. I just shut the door ... During the night? No um I think everybody's worn themselves out (laughs). With all the screaming and yelling I think they wear themselves down and .. and then everything goes quiet. It never bothers me you know. And by and by the time I watch whatever I'm watching a movie or whatever everybody's quiet down. Yeah	everywhere and so yeah gets a bit hectic ... you know what's happening to each person you know basically yeah so it gets a bit personal. I mean their visitors are your visitors in the end. That's not a problem but there's bugger all privacy to a certain degree you know. You got these [curtains] here, sometimes people are emotional or they're in pain or whatever, I mean that comes straight through ... you don't get a lot of sleep, disrupts your sleep ... you know, one thing you need in here is rest" 2657-04 – four-bed room "I don't know what I've done. The last two patients that have been with me [have had] ... Alzheimer's disease ... I just ignore them ... It's not my job to look after them ... sometimes he's um getting up at two or three o'clock in the morning ... and he often puts the light on when he gets up." 2657-05 – two-bed room "that bloody bell [laughs] sorry... Pain in the neck! [laughs] ... I've got hearing aids which make it worse. So it sounds as if it's right in my ear ... When you press the buzzer it's just one beep. But the longer the buzzer's on, the more persistent it gets. ... And if anyone pulls the plug it beeps like that too because they've pulled it out the socket and that's ah ah you know if you're in trouble" 2657-06 – two-bed room "Last night we had a, we didn't sleep too well because [my roommate] was very restless all night, but I don't mind that because she's got dementia, and I nursed my husband with dementia so I know she can't help sort of singing out or trying to get out of bed, when she shouldn't, um so I don't mind, you know, hitting the buzzer [laughs] to sort of let the girls know she's she's on her way out [laughs] ... if somebody needs help, you you help them. If you can do it, do it! ... and the same if anybody speaks to me, I always speak to them ... You do exactly the same when you're walking around, you say hello to everybody!" 2657-06
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	no it doesn't bother me because I'm not I'm not sleeping so, it's not bothering me see. No they're alright. Mm." 2656-08 – single-bed room, ensuite "this room is quite privacy ... sometime I'm listening to Buddhist chanting and or philosophy or just meditation or chanting keep chanting on on my own. Sometimes out loud, sometime in my head. ... Yeah so I feel privacy this room's nice." 2656-09 – single-bed room, ensuite "The ah the room is is very nice but um the hallway is very noisy at night so I try and keep the door closed. ... there always seems to be one who constantly requires the nurse, and always talking and um and always yelling out nurse, nurse, nurse, and that wakes me up every time. ... And the hallway out there with the doors being opened and closed it's very annoying. ... must be a door here that keeps opening and closing ... The fire safety door must be ... makes a distinctive noise. Kind of a squeaking" 2656-10 – single-bed room, ensuite "the thing I find amazing is um we still haven't moved away from those pull around hospital drapes. ... that's common to all hospitals and we don't seem to have moved past that. I I find that amazing that we haven't come up with a better system somewhere along the line to for privacy. You know like you get situations where if you're sharing a room with four people there's going to be disruptions I understand that but those disruptions can be either non impacting or impacting and if they minimize the impact that's obvious to me in that situation it's probably better for patients if it doesn't impact them as much. Um to me it aids their recovery. It doesn't help the sleep at night particularly if you've got you know doors, lights going on and off ... an ideal situation would be to be in my own room, yes, that would be ideal however I'm practical enough to realize that I'm in the public health system and you need to have beds available ... an	"[I feel like I have] too much [privacy] sometimes ... [I'd like] someone to talk to, but there's no one to come. Me daughter's gone home. ... [my roommate] doesn't talk and when she does I can't understand if it's .. she sleeps all the time. She told me to turn me telly off the other night cos I was watching the football, and she said I can still hear it. I said you can't it's turned off ... and I said to the nurse did she check her telly and mine. She said no they're both off. But I don't like to put it on her to annoy her, but then I like to watch the news and things myself so what do I do?" 2657-08 – two-bed room "I'm quite comfortable in here. Very noisy hallway. It's a very, very noisy area to be in. ... when I was there I was near the nurses' station and it drove me mad with people all the time but here it's very, very noisy up and down this corridor. I can but then I go to sleep but sometimes you think oh I wish they'd be quiet (laughs). They'd be crashing things and noisy. I think every hospital should have a little thought about how they can soundproof some of the areas that are public more for their patients. ... Or make some of the staff more aware. Particularly at night. ... it's a bit confronting especially when it's near your door or your wall. [I think] Who's, what are they gonna do? Are they gonna break into my room or is somebody going to accidentally come in here? ... You know you hear somebody out there and they drop something it's really noisy and you think oh was it? Is there something wrong? ... That the volume of the door slamming should be reduced. It should be made clear to people that others are sleeping. Little old ladies not just me. ... It's terrible. It's deliberate in that they just slam the door and walk down here and another door slams and what do they have to do that for?" 2657-09 – single-bed room "the first time I come in I was [sharing a room] with an old chap down there. ... I got kicked out of there because I I was talking to
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	ideal situation would be to have one room per patient ... my medical needs are low and I'm fairly mobile. I don't .. to me I'd be a waste of space in a in one room quite frankly. Um ah I don't think that that's fair on people that need you know, there's priorities I understand that too but in an ideal situation it would be one person one room but you know I just think that maybe two people per room that size, where I am now, I think two people. ... interaction with other patients I believe is good. I've enjoyed like [name of roommate 1] the guy directly not opposite me but next door to me but across the thing, an older elderly Italian um nice gentleman. We got along well um and um um I enjoy his company. We talk about things you know um [name of roommate 2] just across directly opposite me ah is about my age um he's, him and I interact well. [Name of roommate 3] who's on the corner diagonally opposite is um ah suffering the consequences of a stroke, a fairly severe one so you know and he's a little bit different. Ah but that's you know, that's just the way it is. I think interaction with other patients is good but what I'm saying is if there was two you can still interact. ... you know you could still bounce things off each other and things like that and if there was um common meeting area where patients go and happen to have a coffee or whatever" 2656-13 – four-bed room "I'm happy enough in this room. It doesn't worry me with people in the room. It does other people but not me. I'm happy in this, yeah cos I mean you could talk to talk to the other folks" 2656-15 – four-bed room "Um two [patients in a room] might wear you out because I find that even just having a conversation tiring. You know if you were trying to keep up a conversation with someone else all day long you'd be zonked at the end of it all. ... you'd hope they were an interesting person. ... could be um all a bit wearing. ... I quite like [being in a room by myself]. Bit more privacy so I like it	me wife and me daughter in me sleep ... I think I might have been some noise. They shifted me out the next day. [In a private room you're] sort of your own boss ... if you share it with someone else and they've got visitors coming in you know you feel a bit out of it. ... Oh yeah you don't want for much in this hospital. ... over in those wards [in the old hospital] you're all sort of being together because four or six beds. I forget how many it was. I think it was four but there seemed to be a lot more people around. An invasion you know but now there's a lot of private rooms." 2657-10 – single-bed room "[my bedroom is] alright [but] not when you're stuck here on your own. You got other people coming in and then you can talk to people ... I don't like being on me own it's horrible ... That gets a bit boring. ... just listening to everything go on [in the other beds] ... that way you know you're not alone" 2657-11 – four-bed room 2.3.20 "I just listen to me wireless [when I sit out in the corridor]. And don't interfere with the other person in the bedroom. Because I'm a bit deaf I can turn it up a little bit" 2657-12 – two-bed room "it's been stuffy [in my bedroom] ... cos some of the [nurses] like to have a chat at night so they you know close the doors cos they want you to sleep, you know. They're not there to chat, they're there to work, you know, and it makes it hard because you wake up and you're hot. And you wake up you're cold and you wake up you're hot and ... it's very noisy here cos there's no carpet. ... just a hard hard floor and everything bounces off the walls into the bedrooms" 2657-12 – two-bed room "There's been three of four changes [of roommates] since I first got here. Not too bad you get to meet different people." 2657-14 – two-bed room
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	better than being in a shared [room].” 2656-16 – single-bed room, ensuite “there are good things about [the ADL bedroom that I’m in now] but there are other areas that make me cranky. I feel very isolated but I guess part of that is about, you know getting ready to [be] going home ... Q: Do you mean at home you would be alone? A: Yeah except my cats ... Q: In the room you were in before did that also feel isolated? A: No I loved it. (Laughs) I mean it was a single room with its own bathroom and lovely view and that sort of thing. So I could .. I felt more relaxed. I’d sit and just look out or watch the building [construction work out the window] or that sort of thing and I think just sort of felt like if the door was open you know and people were chatting more. Q: Pass by? A: Yeah yeah generally I did like being in there and it, I am just that sort of person that I do like to be very private ... I liked my [old] room (laughs). I think it it was just it was comfortable and I didn’t have to think about other other people really” 2656-18 – single-bed room, shared bathroom (moved from a different single-bed room, ensuite) “I hate having a shared shared bathroom. That’s just me I’ve never in my life shared a bathroom and a couple of times I’ve had, like in the middle of the night, there’s someone who’s just been messed all over the floor and all there and I’m standing there thinking why am I looking at this?” 2656-18 – single-bed room, shared bathroom (moved from a different single-bed room, ensuite) “from a personal point of view, um which really doesn’t bug me that much, I don’t like having a shared toilet ... I always have to think is there someone else in there before I go. Like sometimes when I want to go it’s very urgent. Ah and then sometimes there might be somebody there. ... Whenever I’ve had a single ward anywhere [else] I’ve always had my own toilet. ...	“Too many fellas in one bloody compartment any how ... I was expecting to be in a little you know like have in hospitals a little [private] room like that ... [My roommates are] alright there for the first two days but afterwards there’s just ... they’d be talking to someone else and you just be hearing them say the same bloody time and time and time and time again ... been a pain in the arse” 2657-15 – four-bed room “If those bloody bell don’t shut up I’m gonna kill the bastard [patient alert bell is dinging in the background] ... That’s one one thing keeps a fella awake all night ... You should try to sleep with the bastard” 2657-15 – four-bed room “Oh [my sleep has been] terrible. Too cold and the noise at nighttime. There’s always trolleys going past and the beepers going off. Buzzer things. You can hear it outside the door. Someone’s always pressed it. If it’s not me it’s somebody else.” 2657-16 – single-bed room, ensuite
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	Q: Would you like opportunities to be able to talk to other people more? A: No not particularly” 2656-19 – single-bed room, shared bathroom	
3.2. Social connection in hallways and therapy spaces	“they [the other patients] start waving to you through the door, you get to know them ... All I see [in the hallways] is a lot of depressed people. One after another. And you can see some in a lot of anguish and some not. And you just go past it to the next one. And then all of a sudden it just goes into a blur in your head and you don’t worry about it. You can’t! You can’t take it in. There’s always somebody worse off than you, yeah.” 2656-01 “I’m chatting to some of them now. Yeah so there’s one lady and a couple of others that I’m doing the gym with and some of that. ... I felt a bit guilty cos she’s been here for a while. And so I said look some of them I just can’t talk to. At the moment I can’t even make the, which I would in the past I would have gone around and I would have made small chat, but I can even make that. ... the main reason I’m closing [my bedroom] door here, there’s a young man who’s gotta um he’s got an intellectual disability ... I know a few people here have treated him fairly poorly ... I feel sorry for all of that, but I am just I am not up ... I just couldn’t cope with somebody just doing doing that. ... And that’s why I go to bed [laughs] I go to bed and watch telly cos I just figure cos some of the others have the noise on really loud don’t they and so I just do that, so I normally go to sleep, and then I’ll get up um early and have my shower and then sit and read or sit and do that [points to crossword]. Cos that way I feel like I’ve got the space to myself.” 2656-02 “when I look at some of them [who] I go to the gym and all that with I’m probably physically I’m still probably the most mobile. ... [And] the OT kitchen around the corner ... it was quite nice and it was actually another way to meet um some there are a couple of quite nice older women that I’ve seen since then that	“If I recall a particular nurse if she might be on. Not to go and see her, but I think oh it’s nice just to say hello [when I walk in the hallways] ... Just to say what their feedback to you might be. ‘oh it’s great to see that you’re walking better than yesterday.’ But then one of the nurses this morning said ‘oh you’re very unsteady on your feet.’ I’m thinking um I thought I was going really well! [laughs] But yeah um just their feedback as well just to see what their reactions might be in regards to your progress and how you’re getting along. ... I try and make it each morning first walk just to the little table that’s here [in the hallway], cos I think it’s quite pleasant looking out [the table is by a window], um and we come at night, I come at night time to this area [lounge nook] with my younger daughter, um probably 20 minutes, and um yeah it’s sort of enough for her to have a bit of a look around as well as I have a look as well.” 2657-03 “love it in [the community room where I have breakfast group] because everybody’s friendly. You talk to everyone. Um and you see how they develop ... And you make friends. You you do. You really make friends. Um I’m one of the lucky stroke victims. I wasn’t as bad as some of them. But you see the progress of the ones that that um you see the ones that um really do improve. Like seen one today that’s been coming to physio, and he could hardly walk 3 days ago, now he’s walking around with a walking stick” 2657-06 “my next door neighbour [in room next door] while he was here J[name] he’s gone now, he’s gone home. ... He’s not here any more but I got along well with him. ... he’d normally pop his head in the door and say goodnight and good morning. And then I would reciprocate it .. good morning good night. ... And when

I've been chatting to ... they're people who are a little bit more um you'd say physically well not physically able um I'd say intellectually ... so that's a good way for people to talk cos there were one man who's been who was at a lunch I did ... and his wife died you know and they've been married for 30 something years ... and he's moved up to Mornington now and he was really happy to talk to everyone about it." 2656-02 "I remember the last couple of days [at the other hospital] especially the last day we walked right around the hallway of the hospital and there were people everywhere talking and you sort of you know you feel more like alive, whereas here you feel more down. ... See now there's always that bloke [other patient] sitting outside here here, the nurses have had to prop him out there and then wheel him back in [to his room] at night time. ... oh the poor fella you gotta feel sorry for the poor bloke. But what can you do? Nothing much. ... I'll walk past and have a bit of a laugh with him and I say I'll come back out and I've got pictures I'm with ya. And he's happy. It doesn't take much to make him happy really. A lil bit of a human kindness you might say. Costs you nothing." 2656-04 "I thought I would be self-conscious of others working in [the gym], but you're busy yourself and you don't see them [laughs]" 2656-06 "Oh yes this [chairs in waiting area in hallway] is where we came in, this is where we brought [roommate 2] last night oh yes. She knew this place. It was a nice place to sit. We didn't know whether she would talk or not. And the nurse was so lovely, she came and wheeled [roommate 1] around." 2656-06 "I was really quite surprised at how much the gym is used. ... [I like] the people you meet down there ... People like myself.	the kids were here he would pop his head in and say g'day to them. Yeah he was pretty good. A good bloke." 2657-16 "It's just a gym ... when I was in there by myself it's good but it's when ah I don't know ... too many people" 2657-15 "I just realized how one young man worse off, one of the worse off people than what you are, I went shit when we went to the group therapy I went Jesus Christ poor bugger. I was sitting down and he was sitting over here in that chair and I just walked up the stairs and done that walk down the stairs um .. and worked on the punching bag there ... Lot worse than me you know. ... If I can get down there than I'm in a better state than what they are. It's not good but ... They've got some guts. ... You know and then when you see the, the people see you they're all giving you you know praise, not praise they're giving you motivation. Saying have a look at you, geez you know cos they seen you when you're so sick. ... it's a motivation to them too. ... Yeah and they're making you feel good. You know they're making you wanna get up off your arse and do things and not lay in the bed you know. It's easy .. it's easy when there's a light at the tunnel" 2657-12 "One of the blokes W[name of security guard] I really got along with really well. He ah got hit by a car or a truck when he was on his motorbike and it took out all one side of his body with burns so we were in the same sort of similar situation, he couldn't move one side of his body for a long time. And I can't move one side of my body so we had that in common. So we used to talk quite a bit and he was a good bloke. Got on with him well. They were all pretty good blokes but it was W[name of security guard] that I was getting on with really well." 2657-16
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	Having troubles and coping with them. ... you've got some sort of companionship." 2656-07 "[In the gym I feel] relaxed but motivated. Cos there's other people doing things at various stages of rehabilitation and ah ... Oh just I look out the corner of my eye and see someone better or worse than me and the better ones I know that they have been worse and they're getting better so that gives me my motivation. But I, my entire stay here I haven't spoken to anyone else who's had a stroke cos you'd get automatically compare notes. Oh you're doing, well better than me or or I'm doing better than you or whatever. It might create jealousy. ... I don't know whether it's because I'm a loner or not but I prefer to do it myself and not have to share it with anyone else." 2656-10 "if there aren't other rooms anywhere you can at least sit here [on a chair in the hallway]. ... Just a different place. ... and you can see the food sta staff ... I can see them coming and going coming and going coming and going" 2656-11 "all the different sort of people [in the gym] all the time some of them can hardly walk so don't do much ... Some of the poor buggers will never have much future ... [makes me feel] pretty lucky I s'pose" 2656-14 "Here [in the gym] there's you know quite a bit of activity going on generally usually a number of people doing things. And you see a number of people who are in similar situations to yourself and now they're walking and now they're doing things so that's very encouraging. You know that it does work. Like in the occupational therapy class there's another guy who is using a knife and fork to cut up plasticine. I said how long have you been doing that for? He said it's taken me a month to learn how to do this. I thought oh well there you go if you stick at it you can do it. So it clearly works for some people. There's people in there that	
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	you see that are learning how to walk. They're going through the same things that you are going through and they're doing it so you know it can be done so that's that's very positive reinforcement when you see people down there doing things or doing no better than you are. So you know everyone's in it, and they can do it. It obviously works if you keep at it." 2656-16 "every time they take me to the OT room I think wow. One because of the lass [name of OT] and her approach and warmth ... But I don't know there's something about that room whether it's the personality you know the person in it that makes the place doesn't it?" 2656-17 "Well [the gym is] not ever crowded. And everyone's doing their own thing with their own ah attendant putting them through their paces. I don't take much notice of them" 2656-19 "The gym? Well it's sort of too big and that for me to ah join anything" 2656-20	
3.3. Seeking defined communal spaces	"When [my wife is] here we sometimes go here or go downstairs to the canteen. ... [and] I might just sit here [in the sunroom lounge] to have a talk with a bloke ..." 2656-01 "my sister walks me round and we went down to the um sunroom which is you know quite pleasant but you really wouldn't want to sit down there talking with a lot of people sitting there. [The sunroom lounge] is quite pleasant and in the sun it's quite nice but if there are lot of people no. ... there's nothing you can do but I worry about some of these people [patients in the ward] who just sit here and don't have anyone ... cos there's no nowhere really that you can go and sit sort of thing. Not that I would be in there. That little sunroom's nice but you know it's not really big or anything like that" 2656-02	"I think [the lounge room is] good. ... I was thinking maybe it could be a little bit bigger but I mean that's something because I have I guess a bigger family." 2657-03 "I think this [lounge nook in hallway] is nice sort how it is. Yeah. But on the same token I wouldn't come in here if anyone [else] was here. Even though if you met them through your group, I still wouldn't. ... I would say that's just me. If I'm on my own I probably won't go in there because they've probably already started something or they're doing something and yeah I would just I would walk away. ... Back to the [bed]room" 2657-03 "[The lounge is] quite a good space. Yeah ah they have books and TV there and DVDs and stuff so games and whatever so yes I'm not sure how much it's utilized but yeah. But it was a good

	“[The sunroom lounge is] where I turn that’s where you turn make a u-turn ... I think there’s hardly ever anybody in there. I’m gonna to sit there on my own? I might as well come [to my bedroom] and sit in here. Yeah so I don’t use that much. If there was people in there then I would sort of stop and have a bit of a chat with them and say yeah how you going, but when there’s no one in there you think ah well I might as well head for home [to my bedroom]” 2656-04 “they could have more fun faces around here ... Makes you happy ... everything everything is empty today. That doesn’t help with the sick people. I feel I feel empty” 2656-05 “[The café and outdoor area is] a good thing to have there. Yeah because often visitors are um at a loose end. There might be something happening, so they’ve got something to do. ... You know it’s a nice place for people to come and sit, isn’t it.” 2656-06 “I’d definitely make a room a big enough room to hold enough people here that I wouldn’t say everyone would like to go there but some of them to go there ... a homey room you know where everybody can have a little talk and be friendly and things like that. ... I’m in this [bed]room all day. Pretty boring and I’m watching television. Pretty boring. You know what I mean? Until my children come in .. so pretty boring. It’s alright if you’re a sleeper, and I’m not a sleeper ... I like talking. And you can’t in that [bed]room because I .. no one there ... I like people.” 2656-08 “[When my children visit] we go downstairs. Down to um have a coffee. We go down and have a coffee and um if it’s raining we go in the, we still come in and there’s a little place down in the hospital here ... it it’s just where you come in and just over this side you can sit down ... and it’s very quiet. It’s very quiet yeah	space to do [stroke morning tea] ... there wasn’t people coming or going all the time or anything you know you had your own space yeah and it wasn’t threatening or anything, wasn’t medical apparatus everywhere” 2656-04 “Yeah downstairs [at the café] is good [when my wife comes] cos you can have a coffee and have a sit and talk yeah” 2656-04 “Come down [to the café with my daughter] and have a coffee. ... We can talk to one another in private ... well you’re not crammed not crammed in a room. ... [or] we just come and sit [in the garden out the front of the hospital] and yarn and talk.” 2656-05 “This [lounge room] here I like. This one here. Um, you can come in here and watch TV, get a book, um, they played bingo this morning. Um and the stroke people that’s where they bring you for morning tea and a chat ... once a month that is, I’ve only been once ... Oh [and] I’ve played bingo” 2657-06 “there’s a lot of other people lot of other people probably some people would look forward to have people to talk to ... I do I do go through ah PT and talking with” 2657-07 “I need to have positive people round me. ... Yeah. You need that.” 2657-12 “There’s plenty of seating around and I reckon that’s good. They have some good couple of rooms to entertain the kids and that as well so. When the kids do come they can go down there and play and that’s important.” 2657-14 “Maybe bring in some games systems in the common rooms and TVs and have some competitions between the patients. ... In the common room. Haven’t they got common rooms here?” 2657-16
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	... and it's got big seats. Yeah very nice. We sit there. ... instead of sitting up there in that [bed]room ... we sit here and we just talk to the people they go and get the lift. ... the chairs are nice and colourful. You know it's not dull. Is it? And ah people are coming and going for the lift. You know and sometimes they'll have a little chit chat to you. You know and my son and daughter in law they like sitting here. They don't like sitting in that [bed]room." 2656-08 "I mean I guess it part of the the sunroom could be .. you know .. like you've got the TV there so if people don't want to actually sit in your room and shut the door because or .. turn the TV on. If there's someone else on .. you know sit down with other people. ... [The sunroom lounge is] like not in a good position um but it's not really .. very friendly, the books are everywhere and it's not the shape of the room isn't really good" 2656-18 "[I would like], not very many rooms but you know enough [rooms] to to for all the visitors, I mean the patients, to know all one another. To feel a little community there." 2656-20	2.3.12 "comes in here come from long way and they come they can go down and have lunch in here. The other hospital you couldn't do that. ... And I tell you they enjoy it cos they have a rest. If I sleep they say well let's go have something to eat and come back and see me" 2657-13
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Theme 4 - The environment should be legible and patient-centred

Sub-theme	Case 1 quotes	Case 2 quotes
4.1. (Dis)orientation in the physical environment	2.3.4 “the TV screen [by the nurses station with patient clinical information on it]. On that’s got admissions and you can often tell when there’s something coming for you [laughs] ... whether you’re getting moved or whether you’re getting another medication or whether you’re out of the red or... I still haven’t worked it out. I used to have a bed monitor which is now gone. And that was in a red block. ... Where my position is and am I coming up to getting out? Cos that’s where it gets indicated. It’s got the discharges and the dates. And that’s the only place you get true information. Cos you get half stories [from staff].” 2656-01 “[Looking out window] See that’s the gym there and they’re building more um retirement villages and things like that and the cafes just down there. ... it’s interesting cos I was looking thinking well I was wondering whether that was Doncaster shopping town through over there [view] but they said no it’s not” 2656-02 “[I walk in a circle] right around the ward. Yes, I walk down the line and then you come to a dead end. Yeah that’s where I turn right and come back down or when I get here the other side of the desk I could either turn and come into here or I could go further, its only about 20 metres or so, and then you come to doors you can’t open so you make a youie [u-turn] [laughs] and come back to here. ... [The sunroom] that’s where I turn that’s where you turn make a u-turn” 2656-04 “didn’t even know how many floors there were” 2656-06 “Oh yes so I know this is where I would have parked now [have walked out the back of the café and orientated herself] ... Ah this	“Well you’ve got a fantastic view from the [bedroom] windows ... It’s like going in the gym room it’s got one big massive um window. ... you could see the whole the whole town really you can you know and you don’t realize just how big Bendigo is until you look at it.” 2657-01 2.2.17 “I was saying downstairs I don’t know where they are (laughs) ... I guess you know you get put in your wheelchair, you get wheeled around and you don’t know where you’re going. (Laughs).” 2657-02 “my next aim yeah is just to get out[side]. Probably get my bearings more so than anything” 2657-03 2.1.25 “have a little bit more information um about strokes. I know there are things there, but I just I don’t anything, maybe a little bit more information. Apparently they have morning teas and things down there, but I haven’t been or haven’t really known about it until too late to actually go, which that would probably be beneficial um but yes I haven’t been, I can’t say anything because I haven’t been to the morning tea down there.” 2657-03 “Bloody rabbit warren” 2657-05 “[besides my bedroom I go] to speech pathology and gym and that’s it” 2657-05 “Q: Okay. You know your way around. A: Yeah well. It’s been 5 weeks. You learn” 2657-06

is where we sat the other day. She had a coffee and I had just had lunch or something.” 2656-06 “I haven’t been anywhere else. I don’t think. Just the gym. and back here [to my bedroom].” 2656-10 “I just didn’t know [the ward lounge] was here. I didn’t know it was for the use of everybody.” 2656-10 “I was hallucinating and the nurse swore that I was in the [hospital] but I felt like I had been transported to my house in [suburb]. The door closing sounded exactly the same in fact she she even opened the blinds up so I could see that the room the same room. ... I thought I was somewhere wrong .. somewhere else .. wondering how on earth I was out there without being noticed and then I calmed myself and looked at the ceiling and I realized that I was in the same place so I didn’t have anything to worry about ... Because [the bedroom ceiling is] so distinctive. ... yeah it’s saved me a couple of times from making a fool of myself.” 2656-10 “where they’ve got that green felt part near the café” 2656-11 2.1.24 “People need to know the fact that [the café is] available that there isn’t .. that it is there but they also need to say you know that if there was a like an information sheet you know beside your bed for information OK it says OK when it comes down to certain points like the cafeteria operating hours 8 til 5 and not open weekends um .. then people can plan around that you know. Um whereas we had to make up things as we went so yeah it um yeah but it was .. yeah it was ah not a big thing but it’s .. to me it all helps with patient wellbeing and patient um .. cos like I said before early in the piece without patients well if patients aren’t happ well if patients are happy it just makes makes it more difficult for staff because then they get grumpy right and	“I walk around [the ward]. I walk around the 6[th floor ward] a bit but I don’t go anywhere.” 2657-07 “[I go] down to gym. And the toilet. Where else do I go? No, I’m going for breakfast one morning.” 2657-08 2.3.3 “If I had known that [ward lounge] was there I would have gone to it. But there’s nothing to say in here or anywhere that there is a place to go upstairs or wherever to get a cup of tea yourself, to get some magazines and books. No information at all. ... Perhaps if that was advertise somewhere that’s simply and easy to read without having to go to a lot detail would have been nice. Cos I would enjoy going out.” 2657-09 “having a toilet sign inside does not help. The toilet it says, anyone could come from outside and go to it. ... I didn’t realize it was a private toilet at the start because it was so public with the sign. ... I found that very confusing. ... it is a strange .. I don’t think it’s a good place for it because somebody coming from that direction could just wander through.” 2657-09 “I don’t go very far because at the present time I can’t walk that much you know and it’s driving me nuts to be honest. ... It all looks the same to me. ... How they get around those tunnels I’ll never know.” 2657-10 “[The physio took me to the outpatients gym] just to go down and have a look, show me where it is ... I suppose to have a look around and familiarize myself with it.” 2657-14 “Oh the building? Bloody oath the place you can’t find your way from one end to the other ... I don’t know how they find their way around it! Q: What do you think would help you find your way around it? A: Signs. No bullshit. Signs! ... walked around
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	they're less cooperative um you know all sorts of things. So it's .. yeah .. specially I think if patients were um .. given more information um and not have to wait around for information um ah it would be a lot better and there's certain there's certain areas, certain information that staff don't have access to, they've got to wait for the doctors or physios or something like that, but there's certain day to day running that patients can be given adequate information you know." 2656-13 2.1.33 "the sunroom to me is the sign says sunroom .. oh yeah OK it's solar, it's a place where you get sunlight. It doesn't say that there's tea and coffee and anything like that and there is but it doesn't say that and it was only because I sniff around [laughs]" 2656-13 "I don't know it all looks the same" 2656-14 2.1.20 "[We] didn't even know [the café] existed so that's a problem. They need to tell people that. Maybe they're worried that once people know they might wander down there themselves" 2656-15 "No I'm not up to [going anywhere else in the building] yet. The family have offered but they often bring me up drinks. But no I'm not up to that so I can't .. I don't know what the building even looks like on the outside. I just know the corridors, the lifts and that's about it." 2656-17 "This ward is good especially because when you not feeling that, um you know getting used to it and it is that circle ... Yes and you can [find your way back], you know two or three laps or something" 2656-18	the ward and got myself lost three times ... it's so easy bloody easy to get lost in here" 2657-15 "I had a couple more [pictures by my kids] on me door but I don't know where they're gone ... Yeah [they were on] this side of the door so when the door was open and I used to come down the hallway and I knew which room was mine straightaway. Now I have a bit of trouble. I gotta wait til I get to the number and see the number. ... I don't know someone just took them down." 2657-16
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4.2. Convenience and suitability of the environment (fit-for-purpose)	“the spacing of the drops [for the curtain] they got them really big on the ends but where the corner is, it’s too big cause one stays around that side of the corner and there’s one here, you try and pull this way it stops there R: so you can’t close the curtains D: it needs more things put in it so it can roll around. That’s just design.” 2656-01 “if you look look at this lead (points to lead connecting the bed controls to the bed) ... See electrical tape wrapped around it? This was only done 3 weeks ago by electrical tape. That wouldn’t pass. ... It’s electrical. It’s been pinched and it shouldn’t have tape around it, it should be pulled out of service.” 2656-01 “This [wheel]chair. It came off Noah’s ark. It’s a heap of rubbish everybody hates it here. The angle of yer feet. Look at me feet hanging over the end. If I push out it locks up, see? See? When I push back to come back ... nobody knows what that bolt’s for. They got lots of sharp jagged edges on it. This cable – I got caught on the bed there and nearly tore off the thing ... It was sticking out like that. It just dumb.” 2656-01 “this [bed]room is extremely hot. Everyone who comes it here says phew. So I leave that door open there [to the hallway] and that door open there [to the bathroom]. ... Bit of breeze to come through. Otherwise I just wake up in a sweat. ... My back actually feels wet on the bed, which is uncomfortable. I end up throwing everything off. So I wake up this morning with nothing covering me. ... Every now and again I open the door [to the balcony] to let a breeze through but it flaps the curtain there. Flicks it if there’s too much coming through. ... That [balcony] out there I think it’s a waste of space. Everybody says you’re lucky, but I don’t use it. See, if get out there with this, the [wheel]chair, I’ve got to really struggle to turn this around again. Not only that, it’s like a sauna. Glass, two walls, it just heats up.” 2656-01	“I mean I see they got this picture of someone who’s had a stroke [showing how she should position her affected arm on a pillow] but I can’t get over there to really see it” 2657-01 2.2.5 “I’ve got a cleaning lady that chats to me in the morning and she does 26 rooms and shower rooms all that cleaning. Elderly lady and she’s very nice and she give me a rubbish bags [taped to her table] so that I don’t have to worry and I thought that that’s lovely ... she’s doing it for everybody giving them an empty bag because she said the bags are only little and so it’s worth it. So she saves all the shopping bags see and then makes for the cleaning. Makes it easy” 2657-01 2.2.15 “I put down that the nurses must assist with meal, but they don’t .. they just leave them. See I was got a fork upside down managed to get the milk out and stabbed it so I could get meself a cup of tea and then there was a lovely little box of .. just a little pack of fruit but I can’t open the .. so there I was bouncing it about, turning it over ... There was a lovely little roll in a bag. And it was lovely and warm and there’s butter there and jam. I can’t do none of that. And so there I was with the roll on me beating the hell out of this paper bag well it was a plastic bag which would not open. Trying to stab it! [laughs]” 2657-01 “the first day I went [to the gym] was quite a few people sitting [in the waiting area in the hallway] in their wheelchairs waiting for their turn.” 2656-01 2.2.29 “you had these these things rails yeah and when I was up here in the other room .. the end room um they couldn’t find the trolley to take me to the toilet so they put me in these sort of straps and they sort of swung me along (laughs) .. I thought my god I’m going through the roof! ... The hoist that’s what which is marvelous especially if you’ve got a customer or person that might be a bit heavy or awkward for the girls to push around but
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	“with some of the, the locks on the doors. So there’s a little lock ... my sister’s been out buying stuff ... it’s got all of these things and some of them are locked. ... there was nothing here. There was no bowls there was no absolutely nothing. So [my sister] just went out and just went to coles and brought you know that plastic stuff. Which is fine, which is fine. Q: So I’m just going to explain that for the recorder, but just that there’s cupboards [in your ADL bedroom] that have signs on them saying plates, bowls, mugs, but they didn’t have any plates bowls or mugs in them. ... A:And somebody came and said oh no all these things are here. Oh, no they’re not! if I’m going to do something I want to make sure that it’s right ... Cooking. Or something like that.” 2656-02 “And that there was a problem with the sink wasn’t working, which I wasn’t, I wasn’t particularly worried about, but everybody else was ... there’s water collecting so that could be potentially a problem ... I don’t know and people have said they have reported it ... the manager’s in the next morning, that was the weekend, Monday, the people were here and they said this has never been reported. ... with the water and just sitting there ... even if you were just lying here. In bed and if you’ve got water that’s just been collected from whatever, um for for you know for a week, now I mean I would never do that at home and I would never do that, but you know even here I think you know it’s far enough away from it, but that’s not good if people are not well and have um problems with their lungs and things like that” 2656-02 “The gym’s quite large and um they’ve got about 2 or 3 walkers or whatever you call them you call them something else ... Treadmill type thing yeah and then a couple of bikes. I haven’t tried the bike, I’ve tried the treadmill. I’ve been using the treadmill um and then there were a couple of over arm things that I’ve done and I was doing those and there’s standing and doing	the machines like the what you’d put into the toilet. You seen these big machines .. They call is a steady ... if you can’t pull yourself up and they put like the flaps down and you sit on that til they get you round to the toilet. Oh well I didn’t like that when I did the hoist but the other machine [the] steady, but the blue one is the one they use mostly and then when I come back from the toilet they sit me on me chair see and I just have to put me feet on it um ... Well it’s easier. It is easy. Actually I’ve got more strength in my right arm than I realized. If only I can get this one [left] going.” 2657-01 “I think we that we can use that [gym] facility a little bit more over the weekend. It would be a tendency to get you out of the room, and you know into the normal regime of things really, what you do during the week.” 2657-03 1.1.13. “these hallways I think they’re great because they’re open. So you can actually see down to the other end. See a bit further really than what you want to go, which is good. ... [you can look at the distance and think to yourself] okay right well I’ve got all that space and yeah I can handle it. ... it’s great because it just feels like opened and there seems to be so much room um to be able to get around whether you’re requiring an aid to get around um I just think it would be a whole lot easier to manage in this particular circumstance, yeah, being open and so wide.” 2657-03 “It’s quite warm in [my bedroom] on a hot day ... it’s the hottest room in the hospital ... It’s a lot cooler [in the gym]” 2657-05 “[The garden out the front of the hospital is] where the physio took me. Cos it’s uneven surfaces ... he took me down here and then we crossed the pedestrian crossing there, cross the other one, and walked up the hill ... it’s all different um textures. And that was for balance” 2657-06
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	your um getting your balance right ... it's just it's big so there's enough room for it. It's got everything" 2656-02 "I suppose that if I was more motivated I would go over there and read [my timetable] but other people have read it and told me about it ... I can't possibly read it at this distance" 2656-03 "I mean have a look at the room we got three beds. Heaps of room. I mean you look probably in some other rooms and they might be a little bit smaller but not that much. Everybody's got plenty of room in here so I think that ah if people are complaining to say aw you know it's squeezey and that. Nah no there's nothing I don't think they have anything to complain about in that respect yeah. So when they brought me here I thought there would have been four beds yeah well I mean you look from that door there looking in, and I thought oh yeah it's a four bed room, but when I walked in and I saw and there was only three I thought well even better. So there's plenty of room. So I don't think I would have had as much room if I had have gone to St Vincent's [campus closer to the city centre] because their rehab was in the old part of the building that rooms were not great you know. You might say room is more at a premium ... the position they're at. You're in the city so they gotta make every foot of space count." 2656-04 "This is about the second week that I'm here and I've seen the physio come here once. ... Never saw him again. ... I walk on me own ... If I want some sort of arm exercises you know to strengthen this arm here. I was the one who got this tennis ball. You know. ... I've been doing this [squeezing the ball]. When I first come in here I could hardly move this [arm] like that. ... And by doing that it builds [my arm] up, builds it up the whole thing. I think they've come to me and said who got you this? I've got it. Me daughter brought me this and she said here dad here's a tennis ball for your hand. ... if I hadn't gotten this ball I would	"probably make [the gym] bigger make it just a little bit bigger cause the other day there was one two three four five six seven eight there was ten of us. And um yeah that was in our group session the single sessions but your never on your own even in a single session you've got your one on one worker but you might have three or four others as well getting there. I still think it could be half as big again even for the staff that are coming there give them more space that's about the only thing I would change I think because it's fantastic." 2657-06 2.3.24 "they have everything set up for us [in the breakfast group room] they have the TV going. Anyone in wheelchairs are they shift the chairs and put the wheelchair under. And it's fantastic, it really is fantastic. ... And they always the the papers on the on the table for the men who want to read the papers. No. It is really really. This is what I found was fantastic. And we all look forward to it." 2657-06 "if I want to read at night .. a light .. I can't see in the dark or reach up for a light" 2657-08 "You have to allow for trolleys and have allow for ambulance men rushing up and down so you have to that space which you might say oh that's a waste of space but you need someone there to turn a trolley or something .. you've got to have it ... [in the hallway] and these little [bed]rooms ... And even that thing they put me on that stand up thing [the steady], it all takes space and you have to allow for that." 2657-09 2.2.21 "I've been taken for a run round the garden and had a look at the helipad. My son did that. Yeah and if there .. there's a wheelchair usually available for everybody to do that with their families." 2657-09
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	not be going home on Friday ... And that was not because the physios, I mean the physio should've come down and said look here there's this [ball] ... a little bit slack on their part. You know you're waiting and you're waiting and you say aw yeah they'll come today or they say I'll see you tomorrow [laughs] but tomorrow never come" 2656-04 "the T.V doesn't work ... it comes on and off. It's got its own mind it does what it pleases. Yeah if she wants to stay on the abc that where she stay nah I don't want to look at it ... Oh look I am interested yes but when you turn the T.V on you think what the hell it's on SBS and it won't go any further ... it would be nice especially at night time ... Well I mean during the day you've got other people walking in but during the night you sort of like the sound, and that's when really you could say oh well maybe it's interesting you know watching something like the old ones that's on like Current Affair at 7 or 730. But I can't get the bloody thing on there and if you do get it it's all black you can't recognise the people and you only hear the sounds ... Oh I can't be bothered [asking for it to be fixed]. You're getting it for nothing. I mean St Vincent's is the same. You get your TV for nothing. But in a lot of other hospitals you pay them between 8 and 10\$ that's where I would be cheesed off if I hired them and it still wouldn't work." 2656-04 "the facilities mm .. not amazing (laughs). Could be better. The toilet I would say. I get into the toilet always find a .. another piece of toilet on top that toilet I don't know what how to describe [participant is referring to a commode] but I had to take it out and put it away. And um the bathroom mm .. the one I'm going in, it's a bit small. There's another one further down but we can't all go onto bath because the other people go in there so .. um it's smaller than ... you haven't got where to hang your your clothes" 2656-05	"[the gym] in my opinion desperately in need of more space cos everybody's getting around each other. You've got leads running everywhere ... it's not them it's just the way it has to be. ... it's unnecessarily crowded because of all the things they have to have there ... [and the gym is] not very well lit. ... Depressing. Because people are trying to get better. They're trying to do better, they're looking at their feet and they're being told to look up, look up, do this, do this and you have to follow instructions of course but um you get an old man in a wheelchair, another man learning to walk over here and there's people running around to get their stuff and their gear and move things it's quite quite busy. That was one of my first impressions of going down there. ... Oh yes around here [in the gym] before they had a loose cord ... it's a danger to people you get your foot tangled in it or something especially those that aren't walking well" 2657-09 2.2.1 "Having the timetable, the way they wanted to do it or had planned to have what appointments I have with physio and doctors or when the doctors are coming which is a big thing um and when visitors are coming in or when you're expecting them and things like that .. something to look forward and then you're disappointed if they don't come (laughs). ... I do [like having the timetable]. In fact I get cross because I can't read it without my glasses. And I can't reach me glasses easily." 2657-09 2.2.20 "during the day people remember to pull it down if it's too bright but at the night time they tend to forget about it and it's really cold coming in there. It is. I have not been cold .. I have not been so cold in hospital ever before as I have been here and I had a blanket .. you know they leave a blanket and stuff but ah the blankets are only cotton ones which is good it's easy to clean but you find yourself catching it and putting it on if you freeze (laughs)." 2657-09
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“All this stuff [equipment in the hallways] ... They’re all over the rooms. But on the other hand where [else] are they going to put them!?” 2656-05 2.2.24 “This equipment it’s remarkable isn’t it? [had just walked past equipment in the corridor] All of them. The things they have to help people. Yeah. Yeah ... it looks to be so simple to use too.” 2656-06 “This is a great place here [in the gym], isn’t it? Yes, when they were discussing whether I’d go to here or to um [other rehab facility] yeah I said I’d like to be closer [which is the other rehab]. Yeah. But then um someone checked it out [here], and they said that this one had better equipment and everything ... and to try and go here ... there’s a lot of equipment here, yes. You know I can see what they mean then yes. And they’ve got room to put the equipment in haven’t they. ... Is this part all new?” 2656-06 “it’s a good wide corridor. Yes great for this [walking frame] isn’t it?” 2656-06 “I’m not up here [in the gym] for the view I’m up here to do the walking you know?” 2656-08 2.1.12 “There’s nothing I like [in my bedroom] Not even the bed .. it’s turned around the wrong way. [I’d have it] That way [pointing out into the room instead of against the wall]. Well I think it’s better than this way. I don’t think it should be this way. ... they said I fell out of bed and I’ve got the wall to protect me ... but they have paper down there [referring to a mat that goes on the floor by her bed when she’s asleep] under there somewhere yeah and they put that down and I haven’t fell out for a long, long time. And look how little the bed is. On the edge side. My bed [at home is] big. Look how little these beds are? Is	“Yeah I like the gym it’s a good gym. The walking things with the mirrors ... I was looking in the mirrors and when I seen meself walking in the mirrors that’s when I started crying because I could walk. I was seeing where I was putting me feet. Whereas before I couldn’t see where I was putting me feet so I couldn’t walk. ... No it’s good.” 2657-12 “I’ve got to across to the outpatients’ gym and they got heaps more machinery and different weights. Our gym’s a bit boring.” 2657-14 “Hard floors everywhere. There’s no carpet in this joint at all is there? It all seems to be hard floors. That’s another thing I might add is a bit of carpet now and again in some places. Makes the floor a bit softer for people to walk on.” 2657-16 2.2.23 “I hate the TV. Touch screen is ah .. some places you gotta put your birth date into it to make it operate. It keeps happening quite often. Got to sit up in order to do it. And then it keeps doing it .. only just put it in it and then later same thing your birthday or your passcode .. and I’ve got to start all over again. Makes me quite angry I wanna punch it. Already punched one and broke it so then if I broke this one they’d never give me another one. I use it as much as I can but like I said it frustrates the crap out of me. Normally I’ll buzz a nurse and get a nurse to do it for me so I don’t break it cos I know if I keep trying I’m gonna get angry and I will punch it.” 2657-16
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	it any wonder you fell out? Because you'd be turning over and you turn, move over and next thing you're on the floor. The beds are to small and you can see like the width and they're all new" 2656-08 2.2.25 "I like the gym down there and the bed that I'm sitting on ... Cos it's solid and easy to balance myself" 2656-09 2.2.44 "we need more hoist for the building because we only have one here (coughs). We have one running running every room and the nurse is working hard with patient .. can't give me anything for the patient and not to run after the hoist and this is really need to be changed .. very important and is .. can make the patient feel very low. Look at the nurse working harder then than what it should be and they really are tired you know. They need energy for the patient not for the hoist ... They have more than more than enough thing to do because not .. I'm not the only one and also you know I think you can imagine when patient want to go to the toilet they have to go .. or waiting for the hoist to come and to take them to the toilets yeah that's unfair you know. ... and a a commode chair we need more .. they always run after the commode chair and people need to go to the toilet they have to waiting from time to time for when the other .. when one finish then the other can use it and usually you know .. they come and take it .. there was no one would remember to bring it back. Because there's not enough. ... Any how look like we don't have enough commode chair. ... [I feel] bad for asking .. yeah. It is. I do feel that. I feel bad for asking and I tend to wait and wait but you know you you only can hold your bowel to the limit time. Yeah. It's very hard those .. hard feeling ... yep. ... But I don't understand why it's happen this way. It shouldn't be that difficult to get these things to the building like this because it it's .. we need it .. the patient need it not the nurse need it." 2656-09	
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	2.2.3 “having to ask permission to do everything [is frustrating]. And needing a staff member to to move the phone six inches or something .. very annoying. It’s just silly little things like that which I want to be back in my own house so I can .. if I needed the phone moves six inches I would think the problems through and find a solution whether it be a mechanical solution or .. calling someone to help me with it or whatever or just get a piece of stick and move the phone closer to me. Ah I’m not allowed to do any of that. No independent thinking and in all respects I’m [usually, prior to stroke] very independent.” 2656-10 2.2.26 “I’m not allowed to get out of bed by myself and I’m not allowed to stand because I’ll fall they say so there’s not much I can do. I can push against the the bed while I’m in bed. And I do a lot of that because I fall forward in the bed so I I lay the bed flat with the electrical thing .. device and then I’ll push against the baseboard and pull myself up towards the headboard and that’s the only exercise I can get. I do that quite regularly.” 2656-10 “maybe there shouldn’t be any carpet [in the hallway]. ... it would be easier with the wheel chairs and tiled surfaces I would have done but then I’m not doing the pushing.” 2656-10 “The airconditioning seems to work down there [in the gym] where it doesn’t work that well upstairs [in the ward]. It’s always too hot. I suppose that the really sick people can’t regulate their temperatures. But um it’s very hot at night going to sleep but then it’s cold in the morning so .. I have no idea what’s going on there.” 2656-10 “I’d utilize [the gym] more. Need more people. More staff so that I can practice more .. but at the moment it seems like two steps forward and one step back. And I want to exercise.” 2656-10	
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	“I need more ah bench space [in the bedroom] cos this [table] always fills up when a meal comes and then I’ve got to clear. A couple more of these [tables]” 2656-10 “these surfaces are very old. ...[and] it’s an old toilet, single flush. They went out with button-up boots” 2656-12 “The waste. So much is thrown out. Food is an example. The trays just go out covered in food. Food could go into a big recycling.” 2656-12 2.3.26 “the room is not conducive to having more than one visitor cos there’s only one chair and the bed and um like on um what’s .. on the Saturday I had my two grandsons, my wife, um my daughter and her partner um and we came down here [to the loungeroom] ... because there just simply is like not enough room. ... if you got more than one visitor at a time there’s nowhere for them to sit except on my walker and if I didn’t have a walker, where would they sit? Particularly if you’ve got other people there having visitors and there’s no chairs left right ... those people have come to see me and if I can’t accommodate them to a point where they’re comfortable being comfortable around in the environment then it defeats the purpose of the exercise of the visit. Um it seems to it seems to .. look in an ideal world you ‘d have you know one big room and six chairs but that’s not always practical I understand that and I get that and it’s not um it’s .. practicalities involved as well but um it’s not always practical to have that situation but at least room for one extra chair or something like would be probably um .. you know or the provision for one extra chair would be probably um a good chair although I don’t know how they’d do it not in the current not in the current set-up anyway.” 2656-13 “Ah [the hallways downstairs], they were wide. They were bright. They were airy. The colouring is open .. it wasn’t .. you	
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	know it was neutral but it was not dark. It wasn't closed in um there was light what comes um you know um. I felt it was good. I felt comfortable walking down it. Yeah. I felt comfortable walking down it. ... there was um maybe areas that I could have if I needed to grab onto grab hold of something. So you know um yeah no I thought it was good." 2656-13 "the toilet facility that services room 4, I don't see why there needs to be a door through to the next room, right. So my idea would be to block off that door and expand, like you've got a shower ah hand basin on one side and you've got a toilet on the other side and a passageway in the middle which is a thoroughfare. Two doors one there and one there which one goes to the toilet and one goes to the bathroom. I would incorporate into a large um ablution unit if you like where there was plenty of room to move around for patients .. particularly in a rehab situation – less trip hazards, less danger of things happening you know. It's ok for people that are mobile but people that are not mobile, we got people in there um that have had knee replacements you know ah .. obviously had difficulty getting around, they're on crutches, they're on walking frames um and the majority of people in rehab particularly are in that situation. I'd take the passageway out. Remodel the bathrooms. Plumbing essentially from a practicality but I'd do a bit of that stuff, I've done a bit of that sort of stuff. The practicalities of it would be .. without spending too much money, remove, fill that wall in along the .. between the um ward .. room 3 and room 4 right? Um open up that that ablutions area um and tile it all, put new tiles down .. they need to be relined .. it's badly .. badly needed relining. Um you know resealing and waterproofing and things like that um .. they're asking for trouble I reckon. In terms of like ongoing maintenance. ... there is a toilet facility in room 3 which is just as bad. It needs to be refurbished. I was there this morning actually because the other one was occupied. ... and I was surprised it	
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	was, to me it's pretty bad I reckon but that's my opinion." 2656-13 "I've also noticed that there are other toilets scattered around and they are quite spacious but they also seem to be a dumping ground for various chairs and so that points to me to a lack of storage. ... you've got two bathrooms side by side. One of them I used the other day and I had to clear um two shower chairs and a weighing chair out of the way before I could even have a shower. Now that means that they haven't got a place to store them and people are just using that as an alternative so you know. ... Just to go and have a shower I had to shift three things (laughs)." 2656-13 "They had these disposable cups and things like [that in the tea making station in the lounge room] which I hate. ... they're a bloody nuisance to get rid of for a start right. ... was disappointing the little paper cup that's sort of .. well not even paper it's kind of plastic actually. ... they're not disposable. They're not recyclable." 2656-14 2.3.27 "sometimes J[patient] will have a few visitors and I haven't been able to find a chair. Like at the start we sat on the bed but I find that a bit hard to sit on it. I need a back on my chair. Yeah you know even like chairs like that stack on top of each other in the corridor they just need something. You know it's terrible having people just standing around ... I get up and I give them my chair and I sit on the bed which I don't like. Some times if you just stand .. you feel like you're not staying .. do you know what I mean? You know you feel like you're not being encouraged to stay. An in our case a lot of the people who are visiting have come a long way. Q: Yep so you wanna be accommodating? M: Yes." 2656-15 wife	
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	“[The nurse call-bell and TV remote] fall off. We all drop them. Everyone drops them though. ... They probably need clamping somewhere to the bed or yeah you know that bar there you could reach there and just grab it. We just stick them in the draw now ... [if I drop it] I can bend down but I can’t feel it.” 2656-15 2.2.39 “It has been a bit a bit difficult to charge the iPad. Like I’d have to put it over there, there’s no power points and he’s got a radio that we’re trying to recharge but we can’t” 2656-16 wife “I wanted [the bed facing] this way so you can see the telly properly. Whereas it was against the wall because I had to sleep on my right side, looking outwards ... they kept on saying a million times until it drove you mad it’s for your own good. It’s for your safety. ... because I’ve got a good strong right side if I’m gonna go anywhere I’ll I’ll roll to the right and then roll right out of bed and they put that purple mattress on the floor next to you so you landed on that” 2656-16 “the rubbish bin on the end [of my table in my bedroom] needs to be about about eight inches wide and 12 inches deep. ... The rubbish bin at the end should be big enough to hold every single [food] container that’s delivered” 2656-16 “this overnight bag which holds about a litre of urine, it’s quite big and heavy and they have to come and empty it a couple of times during the night and it keeps getting tangled around my legs, if there was a hanger on the underside of the table then they could just clip the bag on it and then it drained downwards without a problem. ... You know they’ll empty it before I go down to the gym and sometimes they’ve got empty it while I’m at gym. And one day the gym instructor had to come back up here to get the plastic jug that they empty it into and I thought ooh that was a waste of his time. They need a plastic jug down there” 2656-16	
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	“what I don’t like [in the gym] is as you come through the doors that we’re looking at there there’s a breeze blowing that feels like a quite a strong stiff breeze and it’s as cold as cold. The temperature down there is about 10 degrees lower than it should be. As if you’re going down there to warm up and relax your muscles it’s too cold to do that. I frequently ask the nurses is there a warm shirt in the wardrobe there and I ask them could I put it on before I .. before I go down there which is why I’ve got the second shirt on today. So it’s you know you can’t go down there and freeze to death. You know it’s just it’s too cold to be comfortable. They always say oh yeah it is cold down there so well you’ve got an air conditioning system down there, turn it up.” 2656-16 “It’s pretty busy [in the OT room]. Sometimes you go in there and there will be three other people doing the same session as you are. All doing upper limbs or something so I think .. yeah you have four people sitting around one table while it’s not not quite enough space really there for that. Sometimes they’ve gotta move chairs out of the room to get everyone in. ... I find that sometimes it would be better if you were up a bit higher and the table was actually a bit lower so you’re looking down on whatever you’re doing more. ... If you’re above something and looking down it’s it’s easier than doing puzzles and things when they’re they’re down a bit lower” 2656-16 “The lifts are obviously a problem at the moment and the fact that they have to close one down completely makes everything bank up.” 2656-16 “One thing though I really worried about was when they lost hot water for three days. I thought you’ll have a patient revolt if you don’t get that fixed. ... just a hot shower is something that everyone enjoys. ... Yeah. Cold shower. They said do you want	
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	to have a cold shower or no shower and I said no shower. They said that's what most people have said. They said you can have a hot wash. So they went and got a basin full of hot water and went from there. ... But it's a pretty poor substitute for a hot shower." 2656-16 "it's nice walking on a timber floor [in the gym]. It's quite nice walking on that floor too. Particularly if you can get a bit of speed up and it becomes easier to walk." 2656-16 2.2.45 "They tell me to drink but how can I drink if my drink's over there or if it's anywhere that I can't just do that [reaches for glass] and they don't always think of that. They just say you haven't drunk your drink but I think well could i? And I do say to them how could I. Some of them especially one of the nurses is marvelous. He kept coming and topping up and make sure that the drink was there. Otherwise they don't think of it. I find I have to sometimes and perhaps I'm just getting old and very demanding .. I hope I'm not but I often have to remind the staff to do this or that or say well while you're there why don't you grab such and such and sometimes I think they probably find it helpful and sometimes they I think I'm a damn nuisance. I don't know. I try not to be a nuisance. ... if I think someone's going to come in I leave it til then and I say tick tick tick [have a list] ... Yes well I like to feel as if I have still little bit of control. But it's very limited I know. ... Q: Are there other things that help you to make the most of the control that you do have? A: Yes yes the bell I won't go anywhere without it. And to me it's like at the moment, it's very important with that bell. Try not to use it but at least it's there and I don't feel .. and I'm not saying, alone is not the word I don't know the word but if it's there I feel as if I have control. Q: Yeah. Yeah so are you saying alone is not the word? Do you mean because you don't feel lonely is that right? A: No I don't feel lonely. I just feel connection." 2656-17	
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	2.3.28 “I think very comfortable [having visitors in this room]. They always seem to move their chairs around. That’s all I can say. Very comfortable I feel.” 2656-17 2.2.28 “The good parts [of being in an ADL room with kitchen] are um you know being able to make a sandwich whenever I feel like I have. um Coffee when you want it. Hot toast (laughs) instead of cold. Those things are the good things. ... And it’s not just about that it is nice to have a coffee or toast. It’s you you sort of have to remind yourself that this .. the reason is to get used to doing things .. liking I’m doing myself um medications and doing that sort of thing and all that. I think. Preparing for home so ..” 2656-18 “It’s good to I like that there’s a bright light but there’s also one here [next to my bed] that’s just .. so especially if I’m going going to the toilet or something and it’s in the middle of night” 2656-18 “So sometimes with the physio I’ll just have a sit there [downstairs near cafe] or do a bit of walking out there [in the therapy garden] on the different surfaces.” 2656-18 2.2.40 “[my bedroom is] not very convenient ... Well look at this [nurse call bell cord] it’s attached way over there and it falls on the floor. That’s why I keep it in [the draw] because that’s not going anywhere ... It’s not very ah oh it’s not very convenient for any of the electrical things. And you see I’m not allowed to stand up without the walker, so ah I have to if I want to charge anything I have to get that walker out or if I want to ah put my hearing aids on to charge overnight, which I must, otherwise I can’t hear anything the next day I have to get out get my walker go over there and sort it out um it’s just not conveniently what’s the word? Arranged. Or it’s not ah people ah there’s a word for it you know ah helpful. Helpful will do but that’s not the word ...	
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	Oh no it doesn't doesn't make me upset or or ah annoyed with them or but when it falls on the floor I do say shit (laughs) ... It's just difficult getting getting to things like with the phone sometimes it take four or five or four times of rings before I can possibly get to it and by that time it's stopped ringing here and it's gone through to the switchboard so so knowing of course that it will be family or something and they will ring back again I just wait for a few minutes and they do ring through again. But it's not nothing is conveniently placed ... I can't really find a word for it ah doesn't make me angry, it makes me disappointed ah a little bit of angst like how am I going to get over there in time that sort of thing but it's just a matter of placing" 2656-19 "I could say that there are not enough mirrors in [the gym] because while I was in Phnom Penh hospital they were just there ... lots of glass like a ballet [studio] ... people who can't lift up their, can't walk it's you look to see the mirror better than right now is that you can use as a cue .. but ah there's no mirror reflections giving me an idea of how I look walking" 2656-20	
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Appendix 16: Summary of the Study 3 interview findings sent to participants

ENVIRONS study - Research results summary

ENVironments for Inpatient RehabilitatiON of Stroke patients

Thank you for participating in the ENVIRONS study while you were in hospital. We really appreciate your input and the time you took to help us to understand your experience of the hospital environment and to improve hospital building design for people who have had a stroke.



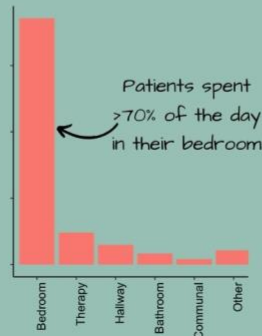
WHO PARTICIPATED IN THIS RESEARCH?

- 36 stroke survivors participated (20 from St George's & 16 from Bendigo Hospital)
- All participants did some questionnaires & an interview
- Researchers spent 1 day watching where participants went in the building & what activities they did.

WHAT DID WE FIND?

1

People feel trapped in their bedrooms. It feels like there's nowhere else to go, or like you're not allowed.



Provide more places for people to go other than their bedroom, both indoors & outdoors

Visitors can help, so we need things to make them feel welcome (e.g., parking, public transport, cafes, chairs, tea & coffee)

THINGS IN THE BUILDING THAT CAN HELP

Give people information about where they can go (e.g., maps)

Lots of windows with views of things happening outside

2

The hospital can feel very institutional. It feels like it belongs to the staff, not the patients.

Give people means & permission to leave their bedroom

Limit features that restrict movement & make people feel powerless (e.g., motion sensors on the bed)

THINGS IN THE BUILDING THAT CAN HELP

Encourage & allow people to personalise their bedrooms

Promote features that give power to patients (e.g., nurse call bell)

3

It can be difficult being around so many other people in hospital, but patients also often get lonely. People want privacy, but they don't want to be alone all the time.

Lounge rooms are rarely used by patients

COMMUNAL SPACES ARE IMPORTANT, BUT THEY NEED TO BE WELCOMING AND ACCESSIBLE

4

Some things in the building can't be used because they need maintenance or because hospital rules & procedures prevent them from being used. Policies need to be changed to support use of the building.

WE WANT TO HEAR WHAT YOU THINK

Do you have any comments about our results? Anything you think we missed? Would you like to receive a copy of the research findings once they are published in a peer-reviewed research journal? Please contact us to let us know.



EMAIL: ruby.lipson-smith@florey.edu.au

ADDRESS: Ruby Lipson-Smith, The Florey Institute of Neuroscience & Mental Health, 245 Burgundy St, Heidelberg, VIC, 3084

PHONE: +61 402 167 360



Date: 12th November 2019

Appendix 17: Time alone in single and shared bedrooms by impairment type (Study 3)

This appendix details the amount of time that participants with and without language and/or cognitive impairments spent alone in single and shared bedrooms. These results were not included in the main body of the thesis as the number of participants in each group is very small, for example, there are two participants with language and/or cognitive impairment in a shared bedroom at Case 1, and one participant without these impairments in a single-bed room at Case 2.

Figure A17.1 shows the amount of time that participants with language and/or cognitive impairments spent alone in single and shared bedrooms as a percentage of the total amount of time that they spent in their bedrooms. Figures A17.2 shows the same as Figure A17.1, but for participants without language and/or cognitive impairments. At both cases, participants with language and/or cognitive impairments spent more time alone in a single-bed room than in a shared bedroom, but participants without these impairments appeared to spend a similar time alone regardless of whether they were in a single or shared bedroom.

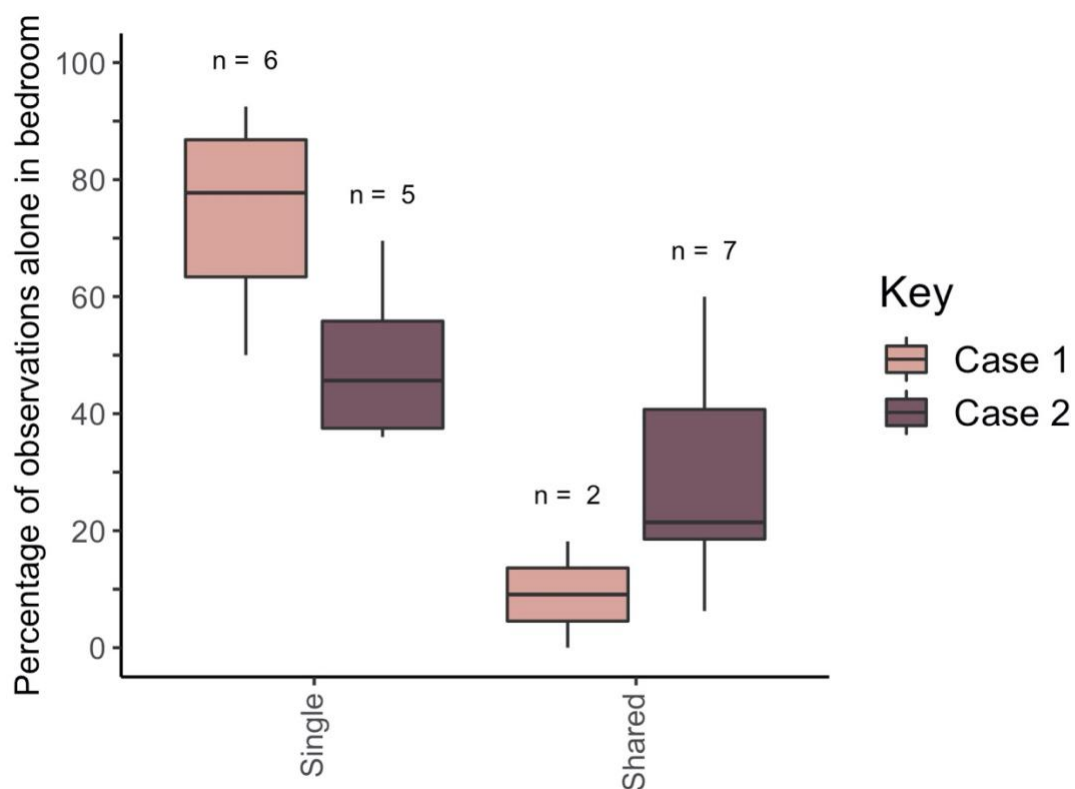


Figure A17.1 Median percentage of observations that participants with language and/or cognitive impairments spent alone in single and shared bedrooms at each case

The number of observations that participants were alone as a percentage of the total number of observations that they spent in their bedroom. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

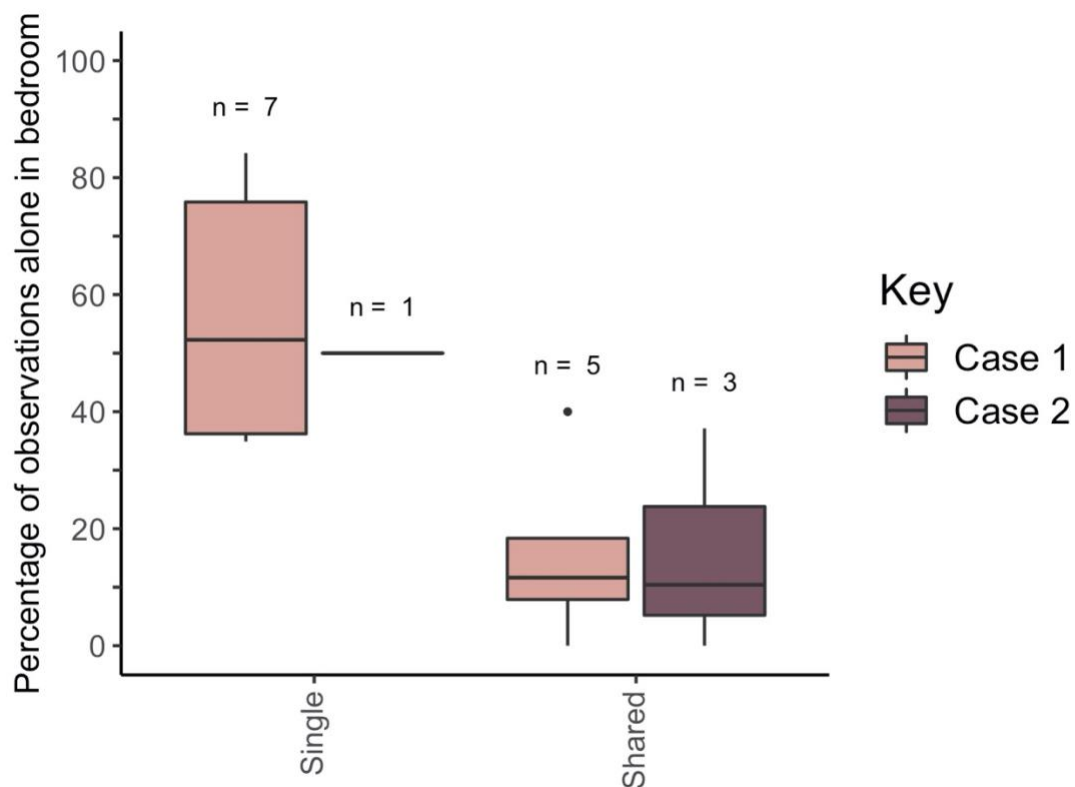


Figure A17.2 Median percentage of observations that participants without language and/or cognitive impairments spent alone in single and shared bedrooms at each case

The number of observations that participants were alone as a percentage of the total number of observations that they spent in their bedroom. Boxes indicate median and interquartile range. Dots represent outliers. Single = single-bed room, Shared = shared bedroom.

Appendix 18: Location of activity by impairment type (Study 3)

This appendix details the amount of time that participants with and without language and/or cognitive impairments spent in physical, cognitive, and social activity as a proportion of the total amount of time that they spent in each location at each case.

Figure A18.1 shows the amount of time that participants with language and/or cognitive impairments spent in physical, cognitive, and social activity as a proportion of the total amount of time that they spent in each location at each case. Figure A18.2 shows the same as Figure A18.1, but for participants without language and/or cognitive impairments.

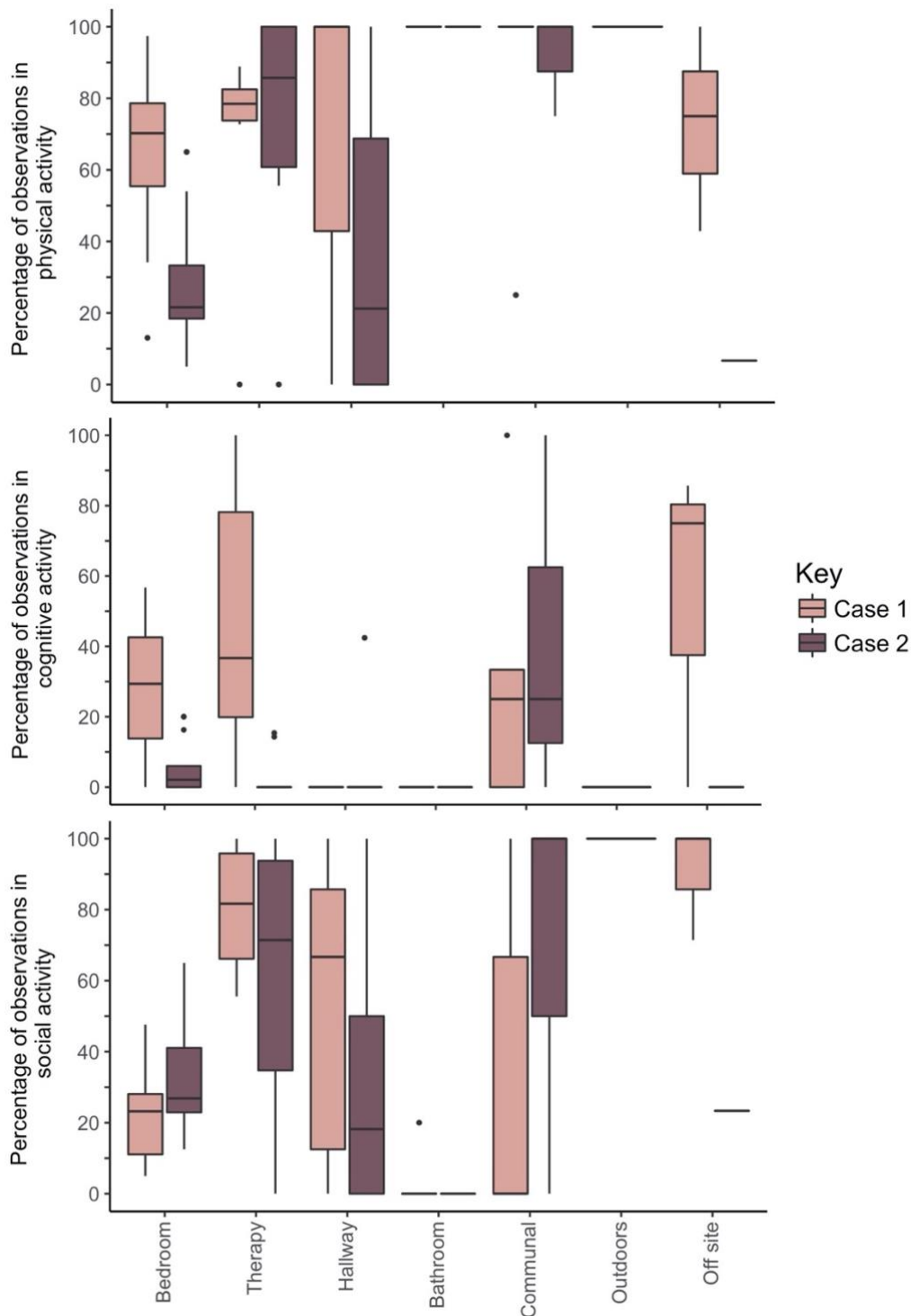


Figure A18.1 Median percentage of observations that participants with language and/or cognitive impairments spent in physical, cognitive, and social activity in each location at each case.

The number of observations that participants with language and/or cognitive impairments spent in physical, cognitive, and social activity (as defined in 4.8.2.3) as a percentage of total observations they spent in each location. Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

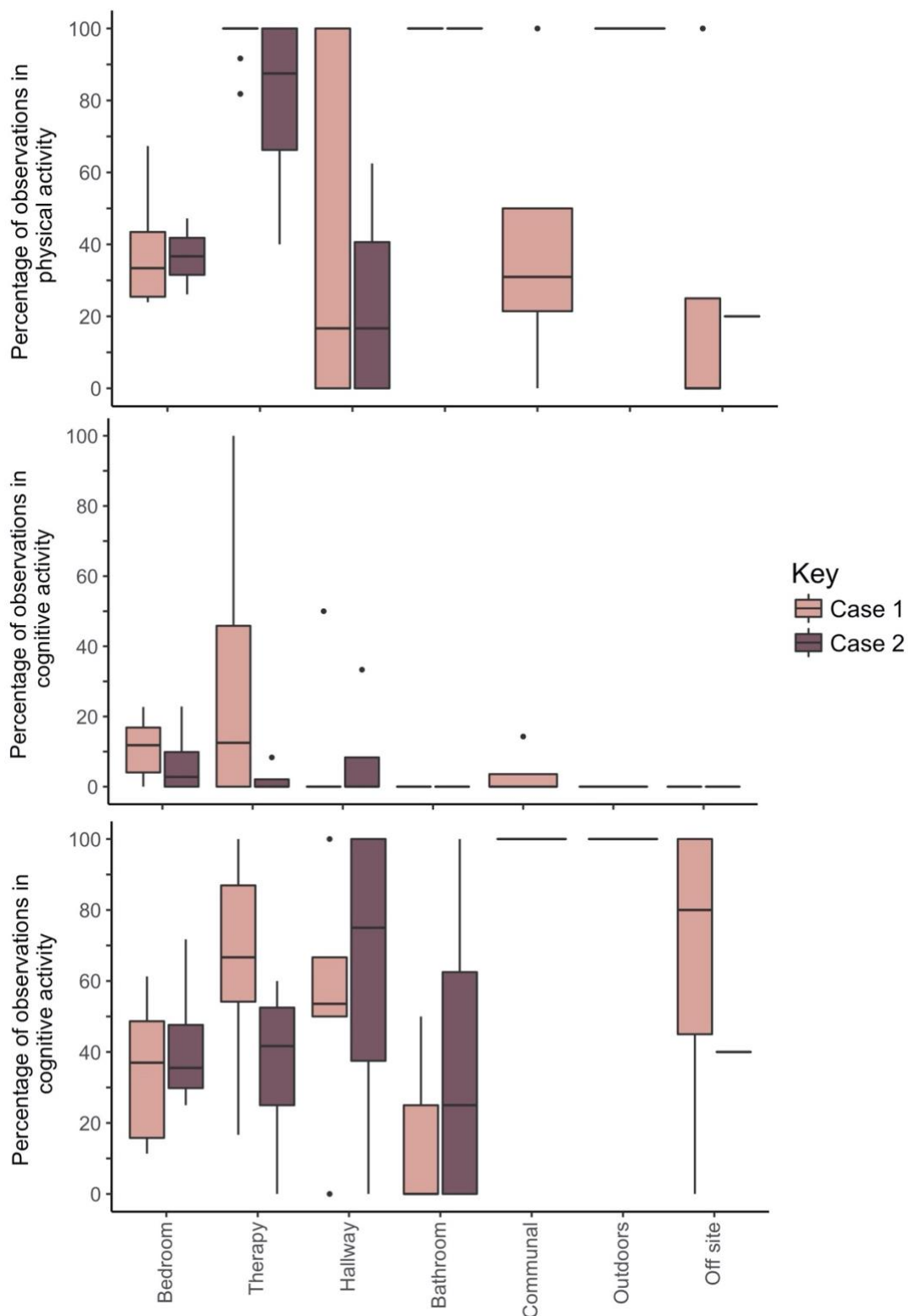


Figure A18.2 Median percentage of observations that participants without language and/or cognitive impairments spent in physical, cognitive, and social activity in each location.

The number of observations that participants without language and/or cognitive impairments spent in physical, cognitive, and social activity (as defined in 4.8.2.3) as a percentage of total observations they spent in each location. Boxes indicate median and interquartile range. Dots represent outliers. Location categories are defined in Section 4.10.2.

Appendix 19: Participants' impairments and emotional well-being (Study 3)

This appendix details the relationship between participants' impairments according to the NIHSS and their self-reported mood (depression, anxiety, and stress), boredom, and motivation, and provides detail comparing the participants' emotional well-being scores to the general population norms.

Figure A19.1 shows the relationship between participants' impairments according to the NIHSS and their self-reported depression, anxiety, and stress. At both cases, depression and anxiety decreased slightly as impairment increased, however, the relationship between impairment and stress was different between cases. At Case 1, stress decreased slightly as impairment increased, but at Case 2 participant stress increased as impairment increased.

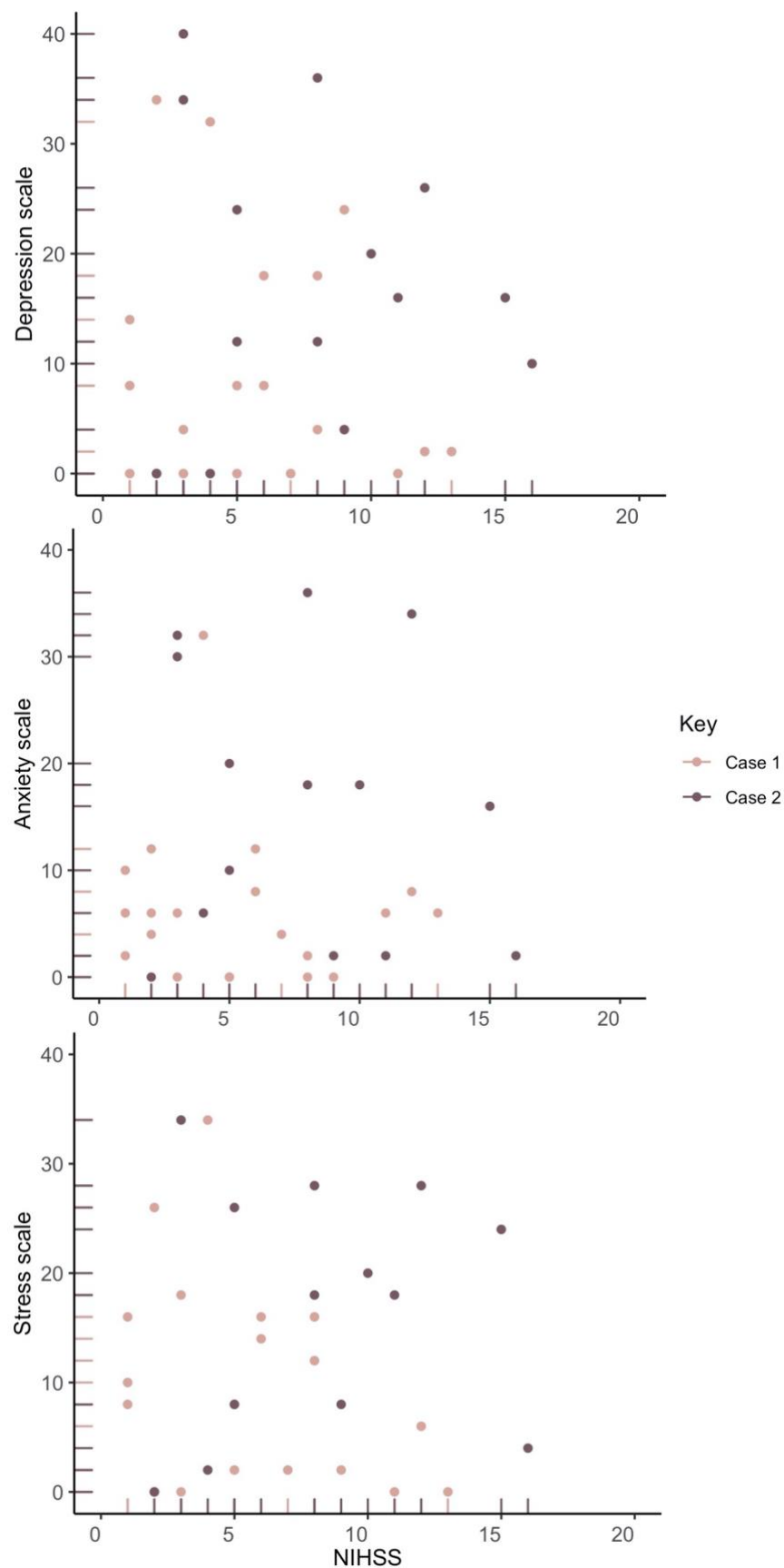


Figure A19.1 Stroke impairment and mood at each case.

Higher scores on the National Institute of Health Stroke Scale (NIHSS) indicate more impairment. Higher scores on the Depression, Anxiety, Stress Scales (DASS) indicate higher levels of depression, anxiety, and stress. Each dot represents a participant.

Figure A19.2 shows the relationship between participants' impairments according to the NIHSS and their self-reported boredom. At Case 1, boredom hardly changed as impairment increased, while at Case 2 boredom increased as impairment increased. This reflects the finding that the environment at Case 1 was perhaps more conducive to people with impairments than the environment at Case 2 (see Section 6.2.4.9). There may have been something in the physical or social environment at Case 1, or something about the type of language and cognitive impairments at this case, which meant that people with these impairments were not less active and not less bored than those without impairments, but the opposite was true for Case 2. Table A19.1 shows the scores on the MSBS for participants with and without language and cognitive impairments at both cases.

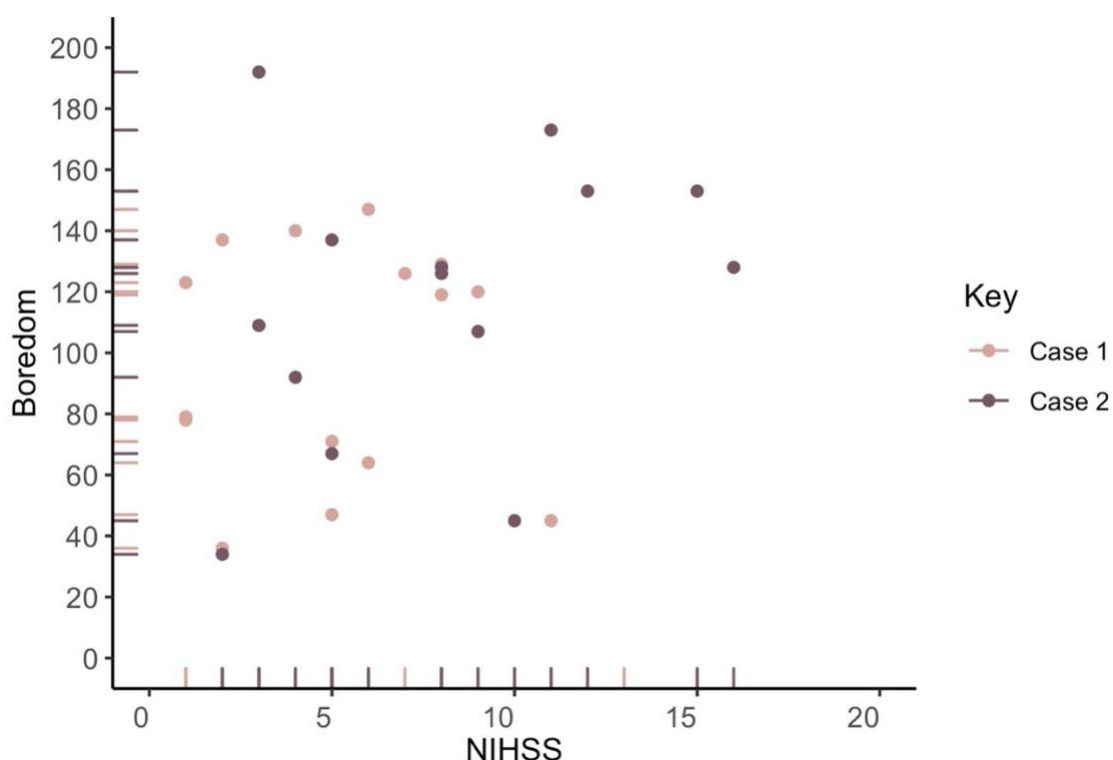


Figure A19.2 The relationship between stroke impairment and boredom at each case. Higher scores on the National Institute of Health Stroke Scale (NIHSS) indicate more impairment. Higher scores on the Multidimensional State Boredom Scale (MSBS) indicate higher levels of boredom. Each dot represents a participant.

Table A19.1 Boredom for participants with and without language and cognitive impairments at each case and population norms

Boredom categories	Case 1 (St George's), <i>n</i> = 20		Case 2 (Bendigo), <i>n</i> = 16		Population norms ¹ <i>n</i> = 1,691 to 1,715
	With impairments	Without impairments	With impairments	Without impairments	
MSBS total,					
mean (<i>SD</i>)	109 (32) [7]	87.1 (43) [8]	124 (39.8) [10]	100 (62.1) [4]	97 (38.8)
<i>z</i> score	0.3	-0.3	0.7	0.1	--
Disengagement	38.7 (9.9) [7]	33.9 (13.2) [10]	41.3 (14.6) [10]	37.5 (27.4) [4]	35.7 (14.4)
	0.2	-0.1	0.4	0.1	--
High Arousal	13.9 (5.1) [8]	15 (8.8) [11]	16.4 (8.7) [10]	12.8 (11) [4]	16.4 (7.5)
	-0.3	-0.2	0.0	-0.5	--
Inattention	17.5 (5) [8]	12.8 (6.3) [10]	16.5 (6.8) [10]	15.2 (8.6) [4]	14.2 (6)
	0.6	-0.2	0.4	0.2	--
Low Arousal	16.8 (8.6) [8]	14.2 (8.4) [11]	22.4 (9) [10]	16 (10.7) [4]	16.6 (8.2)
	0.0	-0.3	0.7	-0.1	--
Time Perception	20.5 (6.3) [8]	17.3 (8.9) [10]	27.6 (7.2) [10]	19 (9.8) [4]	14.1 (7.1)
	0.9	0.5	1.9	0.7	--

Acronyms: MSBS = Multidimensional State Boredom Scale, IQR = interquartile range.

MSBS Total minimum score = 29, maximum score = 203. Disengagement subscale minimum score = 10, maximum score = 70. High Arousal subscale minimum score = 5, maximum score = 35. Inattention subscale minimum score = 4, maximum score = 28. Low Arousal subscale minimum score = 5, maximum score = 35. Time Perception subscale minimum score = 5, maximum score = 35.

¹Australian population norms (non-hospitalised sample) are published by Oxtoby et al. (2016). Medians and IQRs of the population norms are not provided in this publication. The exact *n* for each subscale is not specified in the publication, but it is stated that the *n* for each subscale varied between 1,691 and 1,715.

²Subscales were completed by a different number of participants at each case.

Figure A19.4 shows the relationship between participants' impairments according to the NIHSS and how much they felt that the physical environment helped them to feel motivated for rehabilitation (measured by the VAS). At Case 2 especially, participants with more severe impairments felt less motivated by the physical environment.

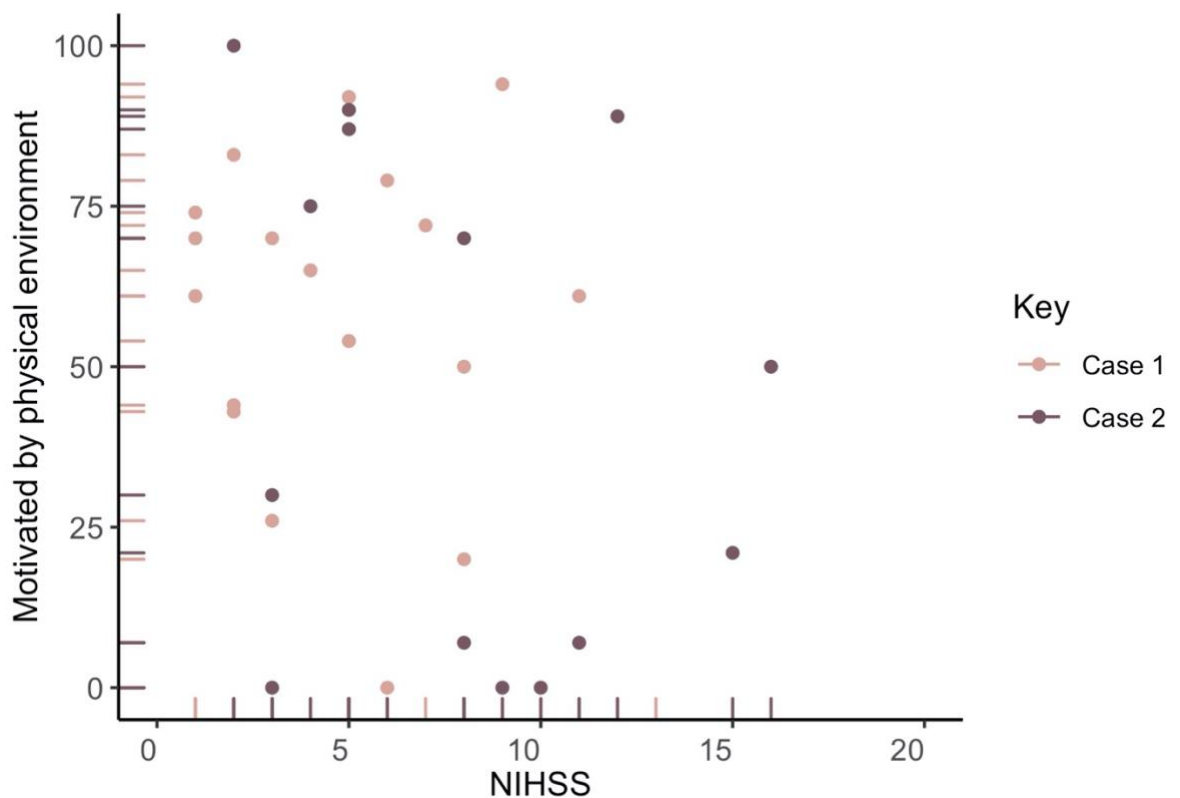


Figure A19.4 The relationship between stroke impairment and how much the physical environment was motivating for rehabilitation at each case.

Higher scores on the National Institute of Health Stroke Scale (NIHSS) indicate more impairment. The extent to which the physical environment was motivating was measured using a Visual Analogue Scale where a score of 100 indicated that the physical environment was strongly motivating and a score of 0 indicated that it was strongly demotivating. Each dot represents a participant.

Appendix 20: Mapping concepts to form topics for joint display tables (Study 3)

Figure A20.1 below illustrates how concepts from the qualitative and quantitative findings, and from the discussions that took place in the peer review workshops, were grouped into topics. This figure has been included in the appendices to illustrate some of the thought process that was involved in developing these topics.

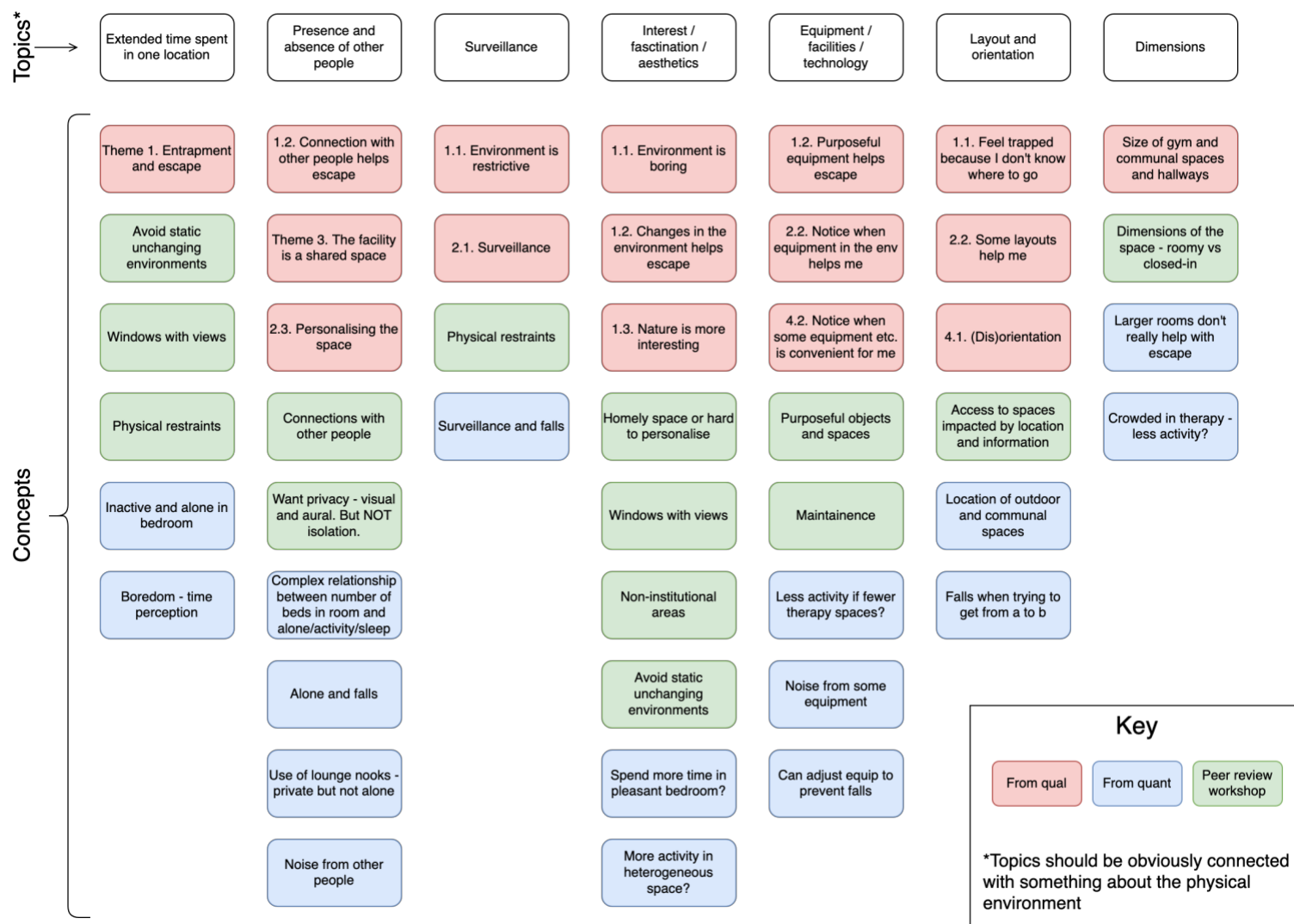


Figure A20.1 Mapping the concepts to form topics for the joint display tables in Study 3.