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RESEARCH ARTICLE

Mixed methods feasibility study of Music Attuned Technology Care via eHealth (MATCH) for people with complex behavioral and psychological symptoms of dementia within an acute psychogeriatric ward

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Abstract

INTRODUCTION: Music-based strategies can reduce distress, agitation, and promote wellbeing in people with dementia. Research in specialized dementia care units is limited.

METHODS: Mixed-methods pre-post study evaluated the feasibility and preliminary effects of Music Attuned Technology Care via eHealth (MATCH) in a dementia-specialized inpatient ward. Staff completed MATCH training and administered MATCH strategies over 8 weeks with enrolled patients.

RESULTS: Twenty-four staff and 14 patients were recruited. Severity of dementia symptoms, measured by the Neuropsychiatric Inventory Questionnaire, was reduced (median change: −3.0, 95% CI: −9.5, 0.5), especially agitation (median change −3.0, 95% confidence interval −5.5, −0.5). Staff reported high acceptability of MATCH (median score: 13 [interquartile range: 12–14]) and implementing strategies enhanced person-centered care. Patients' positive responses to music motivated increased use. No changes in staff knowledge or patient depression were found.

DISCUSSION: MATCH was acceptable to staff and showed potential to reduce agitation symptoms and medication use, warranting further trials to determine effectiveness.

Clinical trial registration: The clinical trial is registered with the Australia New Zealand Clinical Trials Registry (ACTRN12623001134617).

KEYWORDS
behavioral and psychological symptoms of dementia, dementia, music interventions, music therapy

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Highlights

- MATCH decreased the severity of dementia symptoms, measured by the *NPI-Q*.
- Staff reported high acceptability of MATCH.
- Personalized music enhanced person-centered care.
- Patients' positive responses to music motivated increased use.
- No changes in staff knowledge or patient depression were found.

1 | BACKGROUND

Dementia is a growing public health issue, with the global prevalence of people living with dementia estimated to increase from 57 million in 2019 to 150 million by 2050.[1] Over 90% of people living with dementia are affected by behavioural and psychological symptoms of dementia (BPSD) during their illness.[2] BPSD include symptoms of disturbed perception, thought content, mood, or behavior such as aggression, apathy, agitation, disinhibited behaviors, wandering, and sleep disorders.[3] People with dementia are more frequently admitted and readmitted to hospitals than persons without dementia.[4,5] However, BPSD often worsen during hospital admissions due to the unfamiliar and complex hospital environment,[6] resulting in significant healthcare costs.

Managing people experiencing BPSD can cause distress for carers.[7,8] Sustained stress from caring for people with BPSD, combined with low pay and reduced job satisfaction, has led to high staff turnover and workforce shortages in the dementia care sector.[9–13] Hospitals have created specialized care units for people with dementia to mitigate these issues.[14] One study demonstrated clinically significant reductions in BPSD for patients in these units compared to standard ward care.[6] These reductions were attributed to the units having a more structured environment for the staff to learn and provide best practices in dementia care.[6]

International clinical practice guidelines recommend nonpharmacological interventions as the first-line response for managing BPSD,[15] as psychotropic medications are linked to higher risks of functional and cognitive decline.[16] Music therapy is an evidence-based, nonpharmacological intervention[17] for addressing BPSD domains such as agitation.[18] However, the limited music therapy workforce means most people living with dementia cannot access a credentialed music therapist when needed. To address this workforce shortage, HOMESIDE was developed; a program to train family caregivers in intentionally using music to support care.[19,20] Initially, HOMESIDE was designed to be delivered by credentialed music therapists trained in the program. With the challenges of a large trial in the community setting, increasing the accessibility of training flourished into the concept of MATCH—a Music Attuned Technology for Care via eHealth. One component is the caregiver's MATCH training, which translated and further developed the original in-person training that provides caregivers with guidance and strategies for the intentional and targeted use of music to manage BPSD.

The current MATCH training comprises five digitally delivered modules. Each module is tailored to meet a specific set of needs and symptom management: (1) music for mood regulation, (2) relaxation, (3) movement/exercise, (4) engagement and connection, and (5) supporting personal care. Each module contains an instructional video, demonstration videos, suggestions to optimize the implementation of learned music-based strategies, called here MATCH strategies, and suggested actions when people living with dementia do not respond as expected. The MATCH strategies drew from music therapy theories and methods, such as the ISO principle,[21] affect attunement,[22] caregiver-directed singing, musical cueing, music for relaxation, movement to music, and music for reminiscence. Carers have access to curated sample music playlists for each module, supporting the creation of personalized music playlists for each person living with dementia. The MATCH training modules have been tested for face and content validity,[20] and a pilot study in the community setting showed reductions in Neuropsychiatry Inventory-Questionnaire (NPI-Q) severity and carer distress scores ($n = 13$).[23,24]

Given the recommendations of nonpharmacological interventions in dementia care, the acceptability and preliminary effectiveness of MATCH in community care, and the paucity of research in specialized dementia care units, this study aimed to evaluate the preliminary effects on BPSD, the acceptability of the intervention, feasibility of implementing the MATCH training, the enablers and barriers to implementation, staff job satisfaction, retention, sick leave, and patient medication use within an acute inpatient unit specialized in severe BPSD.

2 | METHODS

2.1 | Study design

This mixed methods study was designed to examine the feasibility and preliminary effectiveness of the training components of MATCH[25] within an 18-bed, long-stay subacute neurobehavioral unit for people with severe BPSD in South Australia (Australia). The unit features a high nurse-to-patient ratio (1:2) with an allied health team comprising professionals from eight disciplines, including a consumer consultant with lived experience. The unit employs a permanent, part-time credentialed music therapist who typically provides individual and group music therapy to meet patient needs. However, during this study, the

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music therapist focused on supporting training and research activities, with minimal direct music therapy sessions being conducted.

The primary aim of this study was to estimate the MATCH strategies' preliminary effectiveness on managing patients' BPSD. Secondary aims assessed the acceptability of the professional carer-adapted MATCH training, and the knowledge gained among staff caring for people with severe BPSD. We further aimed to identify enablers and barriers to implementing MATCH within a hospital setting and to estimate the impact of integrating MATCH in patient care on staff job satisfaction, retention, sense of burden, and general well-being.

The trial was approved by the Southern Adelaide Clinical Human Research Ethics Committee (No: 2023/HRE00217) and was carried out as per the ethical standards of this ethics committee. Diversity, equity, and inclusion were addressed in the study, with all eligible staff and patients allowed to participate and all eligible data analyzed with no exclusion based on a person's age, race, ethnicity, abilities, disabilities, gender, religion, culture, or sexual orientation.

RESEARCH IN CONTEXT

1. **Systematic review**: The 2018 Cochrane review found music interventions in aged care reduced behavior and psychological symptoms of dementia (BPSD). However, evidence quality was moderate and no studies of specialized dementia care units were included. On October 6, 2024, we used the same search terms CINAHL Plus, PsycINFO, Web of Science, PubMed, and MEDLINE with no language limits and found no studies of music-based intervention studies in specialized dementia care units.
2. **Interpretation**: Our findings demonstrate that engaging staff in a specialized dementia care unit to implement music interventions after completing the MATCH training enables them to deliver these interventions with high acceptability. This approach shows the potential to improve dementia symptoms and reduce patient medication use.
3. **Future directions**: Future research should test the effectiveness of MATCH in acute inpatient dementia units through a multisite, adequately powered randomised controlled trial against a comparator like pro re nata medication.

2.2 | Participants

Staff: Registered nurses, enrolled nurses, assistants in nursing, medical staff, allied health professionals, and allied health assistants were eligible to participate if employed on a regular basis of at least two shifts per week at the unit. Staff who worked casually or were scheduled to take > 2 weeks of annual leave during the intervention period were excluded.

Patients: Patients admitted to the unit with a documented diagnosis of dementia (any etiology) were eligible to participate. Co-morbidities (including delirium) were recorded but were not an exclusion criterion.

Staff recruitment was carried out via in-person information sessions, email invitations, and informational posters displayed within the unit. Patients were governed by Section 32 of the Australian Mental Health (Forensic Provisions) Act 1990, which stipulated that, due to current cognitive abilities, consent to participate had to be obtained from a family member or legal guardian. Patient recruitment was therefore conducted through information sessions held during scheduled family and guardian meetings and through direct contact with families by the unit's carer consultant. All staff and family/legal guardians were given up to a week to consider and consent to participation. The Dementia Severity Rating Scale (DSRS) was completed for all patient participants pre-trial to assess dementia severity.[26] The scale was administered by the credentialed music therapist researcher on the ward, and the results were verified by another ward staff member.

2.3 | Staff training

Enrolled staff completed the entire MATCH training before implementing the MATCH strategies with the patients (planned to occur between days 1 and 28). The training could be completed in blocks throughout the training period, in an allocated time during a usual shift. Staff were offered additional fortnightly 15-min individual micro-training sessions with the onsite credentialed music therapist on the study team. The micro-training sessions aimed to further refine and extend staff capability to deliver music as an effective, person-centered intervention. The credentialed music therapist maintained digital records of the micro-sessions (MS) using a predefined template.

2.4 | Intervention

The staff were expected to deliver the MATCH strategies to patients between days 29 and 84. All enrolled staff were encouraged to deliver the intervention to all enrolled patients. To promote a patient-centered approach, staff were advised to provide music experiences based on patient's needs rather than according to a scheduled program. Personalized music playlists were created before the implementation period, drawing on information provided in a music preference form completed by patients' families or guardians. Music preferences aligned with the aims of each training module were used to create a unique playlist for each module on a commercial music streaming platform for each patient.

The MATCH training includes staff being trained to identify scenarios where music can be used to assist patients, such as during personal care routines and when patients are experiencing agitation, distress, apathy, low mood, boredom, and sadness. Staff were instructed to utilize the personalized playlists, with the option of being able to edit them

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if needed based on their interactions with patients. MATCH strategies encourage live music use, such as caregiver-directed singing, playing instruments, and movement to the music, where needed[27–29] The interventions carried out with patients were logged using MyCap,[30] a digital data collection tool.

2.5 | Outcomes

2.5.1 | Primary outcome

Neuropsychiatric symptoms

Patient neuropsychiatric symptoms were assessed using the NPI-Q Severity subscale.[31] Total severity score ranges from 0 to 36, with higher scores indicating higher severity. The NPI-Q has acceptable test-retest reliability (r = 0.80).[32] In addition, we presented NPI-Q validated subscales for severity: (i) NPI-Q-4-Agitation/aggression comprises the items "agitation/aggression," "disinhibition," "irritability/lability," and "motor disturbance" (score ranging from 0 to 12); (ii) NPI-Q-3-Mood includes "depression/dysphoria," "anxiety," and "irritability/lability" (score ranging from 0 to 9); and (iii) NPI-Q-4-Frontal includes "elation/euphoria," "apathy/indifference," "disinhibition," and "irritability/lability" (score ranging from 0 to 12). The unit's psychiatric register administers the NPI-Q once a month as part of the scheduled review and monitoring of patients' symptoms. Therefore, we used the reported data instead of collecting data as part of the study assessment. The NPI-Q Distress Scale was not administered as part of usual care at the medical team's discretion; therefore, these data were not obtained.

2.5.2 | Secondary outcomes

Acceptability

The acceptability of the MATCH training was measured using a reduced version (three-item) Acceptability E-Scale (AES) by staff self-report post-trial (satisfaction, usability, and overall satisfaction). Scored out of 15, with higher scores indicating higher acceptability, the AES has a good internal consistency (0.757). It also has good item-to-item correlations, with most items having a coefficient of between r = 0.30 and 0.70.[33]

Staff knowledge of training

A 25-item multiple-choice knowledge assessment was administered to staff pre- and post-trial to determine whether the MATCH training adequately trained the staff to integrate MATCH strategies. This knowledge assessment was developed by the MATCH research team and trialed and refined in previous MATCH studies.[20,23,24] Total score ranges from 0 (no correct answer) to 100 (all correct answers).

Depression

Depressive symptoms of patients were measured using the Cornell Scale for Depression in Dementia (CSDD). The scale (scores range from 0 to 38, higher scores indicating higher levels of depression) has high interrater reliability (k = 0.67) and internal consistency (α = 0.84). Total CSDD scores correlate strongly (r = 0.83) with depressive subtypes of various intensities classified according to the Research Diagnostic Criteria.[34] The CSDD includes mood-related signs, behavioral disturbances, physical signs, cyclic functions, and ideational disturbances in its domains. This scale is also administered as part of the usual clinical assessment of patients once a week on the unit, and data were provided to the research team retrospectively[20,35] However, the four-items related to the domain "ideational disturbances" are not routinely collected or included in the score estimates, with scores ranging from 0 to 30 in this study.

Medication use and costs

We retrieved medication data from the patient's records from day 1 to day 84 using the Anatomical Therapeutic Chemical (ATC) classification (nervouse system, level N). We used the period pre-implementation (days 1–28) as pre-trial data. We estimated costs based on the Australian Pharmaceutical Benefits Scheme (PBS) dispensed price for maximum quantity (DPMQ). The DPMQ incorporates the approved ex-manufacturer price and all relevant dispensing fees and markups and is presented in 2024 Australian dollars (AUD).

Staff job satisfaction, retention, burden, and wellbeing

Staff job satisfaction was measured using the personal satisfaction subscale of the measure of job satisfaction (MJS). This subscale evaluates staff perception of adequately using their skills to contribute to patient care alongside the sense of challenge and interest offered by their job, with scores ranging from 1 (low job satisfaction) to 5 (high job satisfaction).[36] This test has a high internal consistency (α = 0.88) and convergent validity (r = 0.83).[37] Staff retention was measured using average days of sick leave 28 days pre-trial and post-trial. Staff sense of burden was measured by the Professional Care Team Burden (PCTB). The PCTB total score ranges from 0 to 40, with higher scores indicative of a higher burden. For this study, we used only the three-item Objective Burden Subscale, which has high internal consistency (α = 0.711).[38] General wellbeing was measured using the seven-item Warwick–Edinburgh Mental Well-being Scale (WEMBS), range 7–35, with higher scores indicative of better mental wellbeing. The scale is highly sensitive to detecting changes in mental wellbeing, making it an effective tool for assessing the impact of mental health promotion, treatment, and prevention projects.[39] It has a high test–retest reliability co-efficient (r = 0.83), internal consistency (α = 0.91).[40] To compare results with other studies using the seven-item scale, raw scores were be transformed.[41] The scale ranges from 7 to 35 (higher scores mean better wellbeing).

Enablers, barriers, and adherence

The enablers and barriers to implementing MATCH within a hospital setting, as well as the feasibility and adherence to the intervention, were determined through three 30- to 45-min focus groups with staff research participants and their managers, carried out post-trial by a researcher who did not work on the unit (Table S1).

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2.6 | Sample size

No sample size calculations were undertaken for this feasibility study. The final sample sizes were based on the number of eligible staff and patient participants at the unit who agreed to participate during the predefined study period.

2.7 | Data analysis

Data for patients and staff were summarized using frequencies and percentages for categorical variables, mean and standard deviation for continuous variables, or median and interquartile range (IQR: 25th and 75th percentile) for nonsymmetrical continuous variables, and range (minimum and maximum). If variables had missing values, we reported these either in the table or in the footnote of each table. To evaluate changes in continuous outcomes between pre- and post-trial among patients and staff with complete data, Wilcoxon signed-rank tests with Pratt[42] modification were performed, and corresponding effect sizes were provided. In addition, we reported Hodges–Lehmann's median differences for paired samples, with corresponding 95% confidence intervals (CIs) and frequencies and percentages of patients and staff with improved, unchanged or worse outcomes post-trial compared to pre-trial. No multiplicity adjustments were applied. All analyses were performed in Stata/SE 17.0.[43]

The theoretical domains framework (TDF) and COM-B model informed the qualitative data analysis. The TDF is used to identify and understand factors influencing behavior change (e.g., skills, knowledge, and social influence), especially in health contexts.[44] The "Capability, Opportunity, Motivation and Behavior" (COM-B) model, describes how capability, opportunity, and motivation need to be present for changes in behavior.[44] The TDF and COM-B were used in combination to understand and support behavior change, such as implementing a novel intervention.

Two independent coders (A.C., S.D.) familiarized themselves with the data and generated initial codes for the relevant TDF domains. The coders met to discuss codes and continued to code the data set independently. Further meetings occurred to discuss differences and any newly generated codes. Themes were generated through deductive analysis drawing on the TDF[44] and COM-B.[45] The final synthesis outlined the key factors that affected the implementation of the MATCH training within the unit (Table S2).

2.8 | Role of the funding source

The study was undertaken independently of any input from funding bodies. The funders had no role in the study design; data gathering, analysis, and interpretation; writing of the report; or the decision to submit the paper for publication.

3 | RESULTS

Patient recruitment started on December 12, 2023, and ceased on February 7, 2024. Consent was provided for 14 of 18 eligible patients (78%), 12 (86%) of whom completed the MATCH implementation period (days 29–84) (Figure 1). Staff recruitment commenced on November 20, 2023, and ceased on January 31, 2024. A total of 105 staff were eligible, and 24 (23%) enrolled in the study. Twenty-two staff started the MATCH training (18 completed), and 17 (71%) delivered MATCH strategies to patients (Figure 2).

Table 1 shows baseline demographic and clinical characteristics for patients and staff: 29% (4/14) of patients were female; 36% (5/15) had moderate dementia severity, and 64% (9/14) had severe dementia severity; 43% (6/14) had a comorbidity of depression, and 29% (4/14) had a comorbidity of anxiety; 71% (17/24) of staff were female; 71% (17/24) were born in a country other than Australia; 42% (10/24) of staff used music very often; 46% (11/24) of staff used music often in their daily lives; 4% (1/24) of staff played instruments.

Patient NPI-Q severity scores improved from pre- to post-trial (median change: −3.0, 95% CI −9.5, 0.5; effect size −0.56), which included the threshold for a minimal clinically important difference (between 2.77 and 3.18 severity points[1]), with 78% (7/9) patients reporting an improved NPI-Q severity score. A statistically significant effect ($p = 0.01$) in agitation symptoms based on the NPI-Q-4-Agitation/aggression subscale (median change: −3.0, 95% CI: −5.5, −0.5; effect size: −0.84) was observed, with 78% (7/9) patients showing an improved score. A smaller effect was observed on the NPI-Q-4-Frontal subscale (median change: −2.0, 95% CI: −4.0, 0.0; effect size: −0.61), with 56% (5/9) patients showing improvement but not for the severity of depressive symptoms (CSDD scores [median change: 1.0, 95% CI: −4.0, 5.0], and NPI-Q-3-Mood subscale results [median change 0.0, 95% CI: −2.5, 2.0]) (Table 2) (Table 3).

AES had a median combined score of 13 (IQR: 12–14) post-trial, which is 86% of the maximum score (15) and above the acceptability threshold score of 12 (80%), indicating that the MATCH training was acceptable to at least 75% of staff.[33] There was no evidence of an improvement from pre- to post-trial in staff outcomes, as the knowledge assessment score (median change 0, 95% CI -−6, 4), job satisfaction (median change 0.0, 95% CI −0.2, 0.3), staff wellbeing (median change 0.6, 95% CI −0.7, 2.0), professional burden (median change 0.0, 95% CI −1.5, 1.0), or staff sick leave (median change 0.0 days, 95% CI −0.5, 0.5).

A total of 125 sessions of MATCH strategies were documented by staff, with each patient receiving an average (SD) of 8.9 (6.8) sessions (Table 4). The staff primarily used the MATCH strategies targeting relaxation (52/125, 42%), engaging and connecting (36/125, 29%), and mood regulation (32/125, 26%). These strategies were primarily used to reduce agitation (44/125, 35%), encourage relaxation (35/125, 28%), and engaging and connecting (31/125, 25%) with patients. The staff's primary strategy was listening with music streaming (104/125, 83%). However, staff reported that they did not consistently record all sessions when applying the learned strategies.

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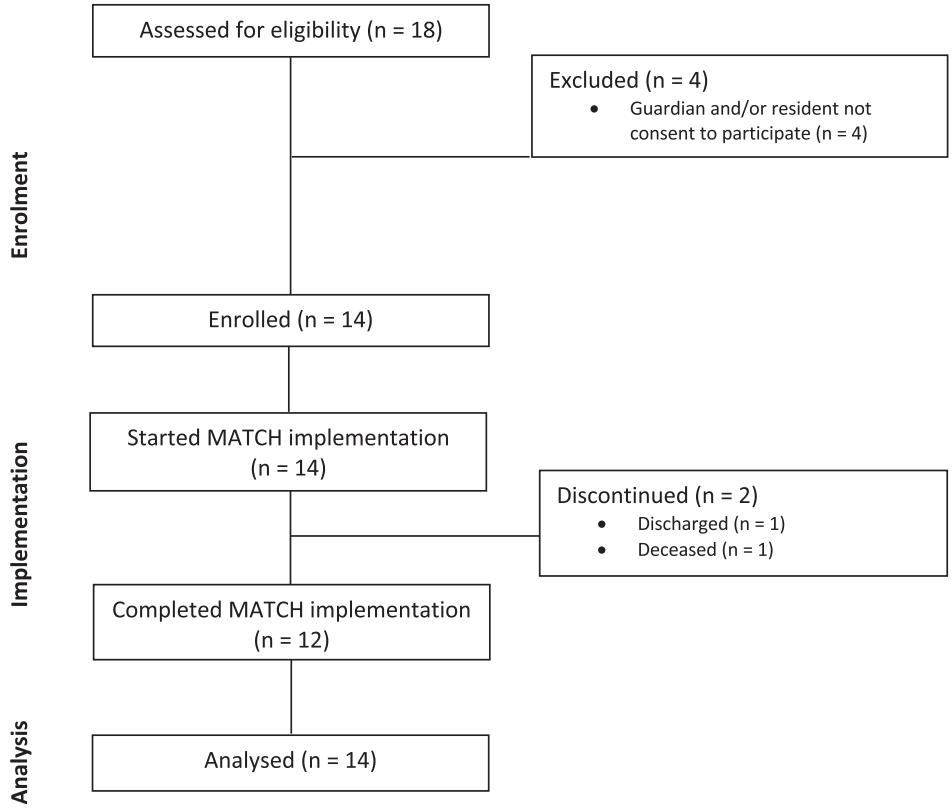

FIGURE 1 Trial profile of patients. MATCH via eHealth. This figure illustrates the trial profile detailing participant allocation and withdrawals for patients. Initially, 18 patients were assessed for eligibility. Among these patients, 14 patients meeting the inclusion criteria and giving consent started the MATCH intervention. Two patients discontinued the trial, due to being discharged (1) or deceased (1). Twelve patients completed the intervention, and the data for all 14 patients was analyzed. MATCH, Music Attuned Technology Care.

Staff perceived impacts of the MATCH strategies sessions on patients are reported in Table 5. The staff generally identified a positive effect of the MATCH strategies on patients across all the modules of movement/exercise (5/5 sessions, 100%), engaging and connecting (28/36 sessions, 78%), relaxation (40/52 sessions, 77%), and mood regulation (20/31 sessions, 65%).

All 14 patients used at least three medication classes for the nervous system at pre-trial, as scheduled, and as needed (PRN medication). Anti-dementia and antidepressant drugs were exclusively scheduled medications. The remaining categories were prescribed and administered as scheduled or PRN medication. Data show a slight reduction in the costs of antipsychotic medication in the first 28 days of implementation of the MATCH strategies and the opioids until day 84. It is essential to mention that changes in prescription occurred pre-trial and during implementation. Staff indicated the use of antiepileptics also used to manage agitation symptoms of dementia (Figure 3 and Table S3).

3.1 | Qualitative results

Data were analyzed based on focus group transcripts derived from contributions from 13 staff who attended three focus groups (FG1, FG2, FG3) comprising nursing staff (n = 5), allied health staff (n = 7) and a carer consultant (n = 1). The reflective notes recorded by the credentialed music therapist at the MS were analyzed. The comments logged by the staff using MyCap,[30] (My_Cap_participant) were also analyzed. The results, informed by the TDF and COM-B, led to six overarching themes: (i) increasing knowledge and skills enhance capability, (ii) music enabled person-centered care and connection, (iii) MS increased staff motivation, (iv) positive emotions and connection from music motivated use, (v) technology knowledge and resources impeded implementation, and (vi) communal environments impacted person-centered care.

Theme 1. Increasing Knowledge and Skills Enhance Capability. The MATCH training helped staff gain knowledge in "why" and "when" to use music with patients [FG1]. Staff used their skills in matching music to support patient arousal regulation. The concept of matching "the music to the patient's mood, was a surprise" as the staff had "never thought about it." [FG1]. After completing the MATCH training, staff considered "how the patients were feeling" and "met and matched the person through music if the person was feeling overstimulated, aggressive or agitated" [FG1]. However, staff felt the MATCH strategies were not useful when patients were "really unsettled." [FG3]. Staff preferred to use music to sustain a stable state rather than transition from unstable to stable [FG3].

Music for relaxation was primarily used to promote sleep. Sleep was considered challenging, as patients could tolerate "very little

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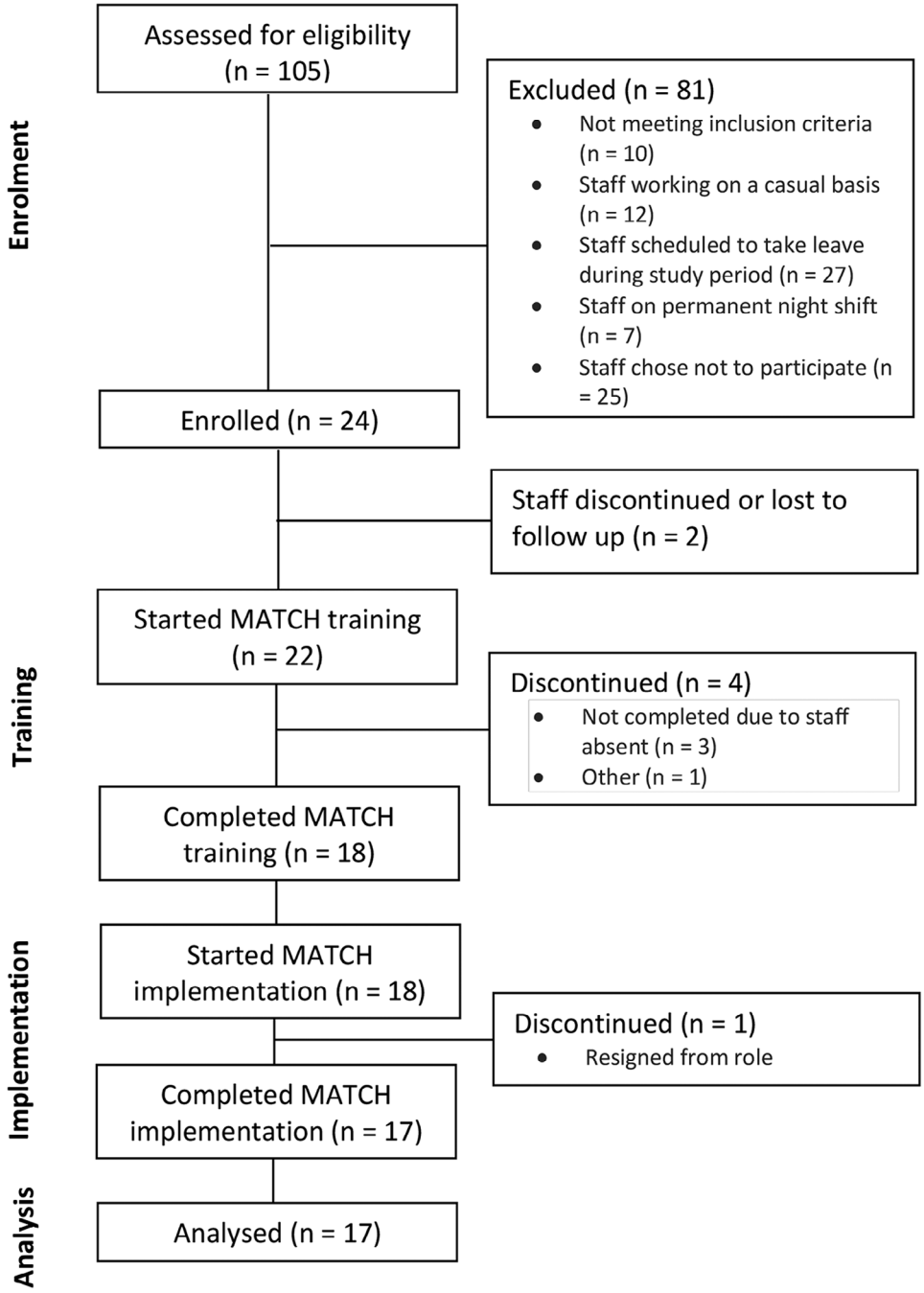

FIGURE 2 Trial profile of staff. MATCH. This figure illustrates the trial profile detailing participant allocation and withdrawals for staff. Initially, 105 staff were assessed for eligibility. Among these, 24 staff meeting the inclusion criteria and giving consent started the MATCH training. Two staff members discontinued the trial, due to discontinuing or being lost in follow-up. Eighteen staff completed the MATCH training. Seventeen staff completed the MATCH implementation as one staff member resigned from their role. The data for 17 staff were analyzed. MATCH, Music Attuned Technology Care.

(environmental) noise" [MS]. Personalized music helped patients "to relax and it promoted more sleep" as it "masked distracting noises that were going on" outside the room [FG3]. However, this required conscious effort, as the staff had to carefully control the music as the "volume of the music, the wrong music or the wrong time" could trigger a negative response in the patient. [MS] Staff acknowledged it was difficult to "get it right." [MS].

Staff spoke of challenges in using music during activities of daily living (ADLs). Staff generally tended to avoid using music for ADLs as they felt the patients were "not quite settled" during ADLs, and they did not want to "tip the boat to escalate behaviors or trigger behaviors." The staff felt they needed to focus "on the task at hand, as opposed to perhaps introducing something else that might be overwhelming" [FG2].

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TABLE 1 Pre-trial characteristics of patients and staff.

Characteristic	Total
No. of beds in RNBU	18
No. of care staff in RNBU	105
Patients enrolled	*14*
Age (years)	72.5 (7.6), [58–87]
Gender	
Female	4/14 (29%)
Male	10/14 (71%)
Country of birth	
Australia	9/14 (64%)
Other	5/14 (36%)
Primary language	
English	14/14 (100%)
Clinical diagnosis of dementia	
Alzheimer's disease	8/14 (57%)
Vascular dementia	4/14 (29%)
Lewy body disease	1/14 (7%)
Other	1/14 (7%)
Length of time having dementia (years)	2 (2-3), [0–7]
Severity of dementia	
Mild (DSRS 0–18)	0/14 (0%)
Moderate (DSRS 19–36)	5/14 (36%)
Severe (DSRS 37–54)	9/14 (64%)
DSRS score	39.1 (7.4), [24–48]
Mobility	
Ambulant independent or with aid	11/14 (79%)
Non-ambulant	3/14 (21%)
Comorbidities (more than one possible)	
Arthritis	2/14 (14%)
Osteoporosis	3/14 (21%)
Hypertension	4/14 (29%)
Diabetes	5/14 (36%)
Abnormal heartbeat	1/14 (7%)
High cholesterol	2/14 (14%)
Gastro-esophageal reflux disease	3/14 (21%)
COPD (emphysema)	1/14 (7%)
Sleep apnea	1/14 (7%)
Asthma	1/14 (7%)
Thyroid disease	3/14 (21%)
Chronic/current pain	1/14 (7%)
Cancer	2/14 (14%)
Head injury	1/14 (7%)
Epilepsy	0/14 (0%)
Joint replacement	2/14 (14%)
Parkinson's disease	0/14 (0%)
Anxiety	4/14 (29%)
Depression	6/14 (43%)
Schizophrenia or schizoaffective disorder	0/14 (0%)
Bipolar affective disorder	2/14 (14%)
Other physical or mental health conditions	11/14 (79%)
Staff enrolled	*24*
Age (years)	42.3 (7.2), [27–54]
Gender	
Female	17/24 (71%)
Male	6/24 (25%)
Non-binary	1/24 (4%)
Country of birth	
Australia	7/24 (29%)
Other	17/24 (71%)
Primary language	
English	16/24 (67%)
Other	8/24 (33%)
Highest level of education completed	
Trade, community or TAFE College	2/24 (8%)
Bachelor's degree	16/24 (67%)
Master's degree	6/24 (25%)
Staff category	
Registered nurse	10/24 (42%)
Enrolled nurse	6/24 (25%)
Allied health professional	4/24 (17%)
Other	4/24 (17%)
Length of time working at RNBU (years)	1.4 (0.5–2.0), [0.0–3.0]
Number of hours working at RNBU per week	38.0 (34.0–40.0), [18.0–80.0]
Length of time working in the health sector (years)	8.0 (4.0–12.0), [0.0–30.0]
Have another job	4/24 (17%)
At similar Unit or Hospital ward	2/4 (50%)
Currently use music in daily life	
Never	1/24 (4%)
Rarely (less than once per week)	1/24 (4%)
Sometimes (about once per week)	1/24 (4%)
Often (several times per week but less than every day)	11/24 (46%)
Very often (once or more per day)	10/24 (42%)

(Continues)

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TABLE 1 (Continued)

Characteristic	Total
Has music been an important or meaningful part of your life in the past	
Not at all	1/24 (4%)
Somewhat	3/24 (13%)
Definitely	19/24 (79%)
Missing	1/24 (4%)
Play musical instruments	1/24 (4%)
MATCH Training completed[a]	18/24 (75%)

Note: Data are presented as Mean (SD), [min-max] or Median (IQR), [min-max] for continuous measures and *n/N* (%) for categorical measures.
Abbreviations: COPD, chronic obstructive pulmonary disease; DSRS, Dementia Severity Rating Scale; IQR, Interquartile range (25th to 75th percentile); PhD, Doctor of Philosophy; RNBU, Repat Neuro Behavioural Unit; SD, standard deviation; TAFE, Technical and Further Education.
[a]1/18 staff discontinued during MATCH implementation.

Music for movement was used to encourage both movement and sitting. Staff would motivate movement by finding "some music and then sing with them or dance with them" [FG3]. Conversely, music helped patients who "walk very much" to transition to sitting since they would follow the beat of the music and regulate to a level where they sit down. [FG1]. Music was used to stimulate engagement when a patient was "a bit low in mood" [FG1] or "in a low place," [FG1]. An example was when a patient had a low mood, "being able to match their [the patient's] playlist to their [the patient's] demeanor helped to energize them" to engage instead of "just be lying on their bed." [FG1].

Theme 2. Music Enabled Person-Centered Care and Connection. The MATCH resource of personalized music playlists enabled staff to connect with patients and deliver person-centered care. Having family input in creating personalized playlists was considered a "very big improvement" in music selection on the unit since it enabled staff to learn about "what sort of music they [patients] like." [FG3]. The personalized playlists helped staff "bridge the gap between who they [the patients] were in the past" and are now, and thus feel an increased connection to the patients. Pre-prepared personalized playlists were useful with time management since having playlists made it "much easier" for staff to focus on engaging with the person "rather than having to search for songs." [FG2]. Staff recognized that the personalization of music sometimes triggered "sad memories" for patients. [FG3]. However, the staff acknowledged that the training provided them with knowledge and tools to deal with this because "evoking sadness is not always a bad thing." [FG3]. They reflected that it could be "a way of venting emotion" [FG3] and that tears "can be cathartic, joyful tears" [FG3]. One participant reported that they had received feedback from patients' families that they had "noticed the difference in the music used and how much more suited it was [for their loved one.]" [FG1]. The family consultant also reported that before the trial, families had felt that a "lot of music was not suitable for their loved one." [FG1].

Inaccurate music mood classification in playlists was a barrier to implementation. The staff used music streaming apps that often incorrectly classified songs by mood and "ruined [the potential effects of] the interventions" [FG1]. The streaming sites were used as they were already pre-existing music resources on the unit during the implementation period. The MATCH playlists curated for this study were preferred since they more accurately matched the intended arousal regulation. The 1-h duration of the initial mood regulation playlist was a barrier to implementation because it did not "transition into slower/softer music quickly enough to meet the patient's window of opportunity. [My_Cap_4]." Based on feedback at the MS, new 20-min playlists were created, which were found to be of a more appropriate length. [FG1]. This highlights an incongruence between how staff used the playlists and what was taught to them in the training.

Theme 3. MS Increased Staff Motivation. Staff recognized the MS, delivered by the credentialed music therapist, as an important factor and "touchpoint" [FG2] in the uptake and continued use of the strategies during the trial. The credentialed music therapist was "very encouraging," "sought good and bad feedback," and challenged them to "do things differently," which "motivated the staff to use it [the program]" [FG1]. The staff "felt heard," reassured that they could "ask questions" to clarify their understanding of the MATCH training [FG1], and appreciated that there was a follow-up on their suggestions, such as shorter playlists and more options being added to the impact assessment form.

Theme 4. Positive Emotions and Connection from Music Motivated Use. Positive emotions evoked by implementing MATCH strategies motivated staff to use music with patients. Staff found the increased connection they developed with patients through engaging in the music intervention resulted in the unit being "a more enjoyable place to work" [FG1]. Staff discovered that the MATCH strategies were a useful tool to help persons with dementia since "music can really bring back other things that have been dormant" [FG3]. It helped foster a sense of team spirit among the staff. Staff commented: "When you see all staff singing along, you also join in and sing along. That just brings that kind of no stress. Yeah, we're all working together" [FG2]. Using the MATCH strategies provided staff with a sense of purpose. They felt that, "It's the whole feeling that you're doing something good at that moment. You know that you're helping their mood uplift [FG]." Consequently, staff felt they would "absolutely [continue with the MATCH strategies] since it's a part of what we do now" [FG2].

Theme 5. Technology Knowledge and Resources Impeded Implementation. The procedural knowledge required to operate music devices and the technological resources available limited the use of music when needed. Staff felt they were "technically not very savvy" and identified challenges such as pairing the iPad with headphones; this impacted the timing of providing music when needed, for example, while patients were getting agitated [MS]. Live music (e.g., humming) was found to be a suitable alternative when devices were not accessible [MS].

Theme 6. Communal Environments Impacted Person-Centered Care. Patients being in communal areas in the unit minimized the opportunity for staff to implement the MATCH training. It was "a real balancing act" to cater for the musical interests of all patients in communal areas

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TABLE 2 Outcome measures for the patients.

Outcome	Pre-study ($n = 14$)	Post-study ($n = 14$)	Median pre-post study difference		Effect size[i]	Pre-post change (n, %)		
			Estimate (95% CI)[a]	p-value[b]		Worse	No	Better
NPI-Q Severity score[c]								
Total severity score[d]	12.0 (11.0–13.0)	10.0 (9.0–13.0)	−3.0 (−9.5, 0.5)	0.10	−0.56	2/9 (22%)	0/9 (0%)	7/9 (78%)
Agitation scale[e]	9.0 (6.0–10.0)	6.0 (5.0–6.0)	−3.0 (−5.5, −0.5)	0.01	−0.84	0/9 (0%)	2/9 (22%)	7/9 (78%)
Mood scale[f]	3.0 (3.0–4.0)	3.0 (3.0–4.0)	0.0 (−2.5, 2.0)	0.72	−0.12	3/9 (33%)	2/9 (22%)	4/9 (44%)
Frontal scale[g]	5.0 (3.0–6.0)	2.0 (2.0–4.0)	−2.0 (−4.0, 0.0)	0.07	−0.61	1/9 (11%)	3/9 (33%)	5/9 (56%)
Cornell Scale for Depression[h]	7.5 (6.0–10.0)	9.5 (5.0–11.5)	1.0 (−4.0, 5.0)	0.61	0.15	6/12 (50%)	0/12 (0%)	6/12 (50%)

Note: Data are presented as median (IQR). Pre-study assessments occurred before MATCH-H Implementation started; post-study assessments occurred 28 days (± 7 days) since day 84 (end of intervention period) unless specified.

Abbreviations: CI, confidence interval; IQR, interquartile range (25th to 75th percentile); NPI-Q, Neuropsychiatric Inventory Questionnaire.

[a]The intervention effect was estimated using the Hodges-Lehmann's median pre-post study differences for paired samples with corresponding 95% confidence interval.

[b]Wilcoxon matched-pairs signed-rank test.

[c]NPI-Q is a shortened version of the NPI. A total of 9/14 patients with available data pre- and post-implementation were included in analysis.

[d]NPI-Q Severity score was calculated as the sum of all 12 items (range 0 to 36, lower is better).

[e]NPI-Q Severity score on agitation scale was the sum of 4 items (range 0 to 12, lower is better), including "agitation/aggression," "disinhibition," "irritability/lability" and "motor disturbance."

[f]NPI-Q Severity score on mood scale was the sum of 3 items (range 0 to 9, lower is better), including "depression/dysphoria," "anxiety" and "irritability/lability."

[g]NPI-Q Severity score on frontal scale was the sum of 4 items (range 0 to 12, lower is better), including "elation/euphoria," "apathy/indifference," "disinhibition" and "irritability/lability."

[h]A total of 12/14 patients with available date pre- and post-implementation were included in analysis. The Cornell Scale for Depression ranges from 0 to 30, lower is better.

[i]Wilcoxon effect size was calculated as Z statistic divided by square root of the sample size.

[FG1]. It was also "not so easy to just take someone into a different space" due to staff time and space restrictions [MS]. In addition, some patients were "very mobile", and so there was a varying dynamic of patients in the communal areas [MS]. Communal environments were also considered "too noisy with staff and everything" [FG2], and adding music "even every small sound" could hyper-arouse and distress other patients. Solutions to these issues included using headphones [FG3] or taking people to their rooms to play music individually [FG2]. The training helped staff to "learn techniques to separate patients and their individual strategies" [FG2]. Staff had differing ideas about music choices and volume levels in communal areas which impeded staff from implementing interventions they considered to be useful for patients.

4 | DISCUSSION

Results of our mixed methods feasibility study using MATCH in a specialized dementia care unit setting indicate that implementing the MATCH training is feasible and acceptable for staff and may impact dementia symptoms (especially agitation and frontal symptoms) and potentially reduce medication use in patients. There were no changes in staff job satisfaction, wellbeing, professional burden, or sick leave. The MATCH training enabled staff to use music to deliver person-centered care. Staff were motivated to use music when observing positive emotions and connections to music by patients. Technology knowledge, lack of resources, and communal environments were barriers to implementation. The pre-trial scores were high for all the staff outcome measures of job satisfaction, well-being, professional burden, and sick leave, indicating a high level of general satisfaction among the staff, which could account for no change between pre- and post-trial. The discrepancy between the lack of change in scores on the staff knowledge assessment and reported improvements in the staff interviews may indicate that the content or delivery of the training may not be sufficient to allow participants to grasp and integrate the theoretical concepts and practical strategies fully. Previous research on care-staff training employed significantly longer and more interactive training periods.[46,47] While MATCH aims to minimize training time to reduce additional time burden on staff, further research is needed to determine the most appropriate length and method of content delivery.

BPSD symptoms, especially agitation, improved pre- to post-trial and reached the threshold for a minimal clinically meaningful difference.[1] People with severe dementia-related agitation are often transferred to highly specialized units where the study was implemented. The unit aims to manage and stabilize those symptoms at lower levels so that patients can return to live at regular and less costly residential aged care facilities.

Corroborating findings from the primary outcome, medication use, and costs were slightly reduced, especially regarding non-scheduled use to manage agitation symptoms, such as antipsychotics and opioids. Conservatively, we would not expect changes in scheduled medicines

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TABLE 3 Outcome measures for the staff.

Outcome	Pre-study ($n = 17$)	Post-study ($n = 17$)	Median pre-post study difference		Effect size[d]	Pre-post change (n, %)		
			Estimate (95% CI)[a]	p-value[b]		Worse	No	Better
Acceptability								
Satisfaction (range: 1 to 5)		5.0 (4.0–5.0)						
Usability (range: 1 to 5)		4.0 (4.0–5.0)						
Overall satisfaction (range: 1 to 5)		4.0 (4.0–5.0)						
Acceptability E-Scale combined score (range: 3 to 15)		13.0 (12.0–14.0)						
Training evaluation (knowledge gained) (range: 0 to 100)								
Knowledge assessment[c]	68.0 (60.0–72.0)	68.0 (64.0–72.0)	0.0 (−6.0, 4.0)	0.77	−0.07	8/17 (47%)	2/17 (12%)	7/17 (41%)
Job satisfaction (range: 1 to 5)								
Measure of job satisfaction scale	4.3 (4.0–4.7)	4.3 (4.0–4.7)	0.0 (−0.2, 0.3)	0.79	0.06	5/17 (29%)	6/17 (35%)	6/17 (35%)
Wellbeing (range: 7 to 35)								
Warwick–Edinburgh mental well-being Scale	25.0 (22.4–26.0)	25.0 (23.2–28.1)	0.6 (−0.7, 2.0)	0.43	0.19	6/17 (35%)	2/17 (12%)	9/17 (53%)
Burden (range: 0 to 12)								
Professional staff burden scale (Objective burden subscale)	7.0 (6.0–8.0)	7.0 (6.0–7.0)	0.0 (−1.5, 1.0)	0.96	0.18	8/17 (47%)	3/17 (18%)	6/17 (35%)
Staff retention								
Sick leave (days)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (−0.5, 0.5)	0.71	0.09	5/17 (29%)	9/17 (53%)	3/17 (18%)

Note: Data are presented as median (IQR). Six staff participants who did not complete MATCH-H Training were excluded from analysis. One staff participant who discontinued was excluded from analysis. Pre-study assessments occurred before MATCH-H Training; post-study assessments occurred 28 days (± 7 days) since day 84 (end of intervention period) unless specified.

Abbreviations: CI, confidence Interval; IQR, interquartile range (25th to 75th percentile); ··, not applicable.

[a]The intervention effect was estimated using the Hodges–Lehmann's median pre-post study differences for paired samples with corresponding 95% confidence interval.

[b]Wilcoxon matched-pairs signed-rank test.

[c]Post-trial training evaluation was measured on day 63 when the staff completed the training.

[d]Wilcoxon effect size was calculated as Z statistic divided by square root of the sample size.

as they are limited to prescribers' re-evaluation, and the PRN is based on care staff's perception of the need or effect of the medication. Caregivers' strategic use of music to manage BPSD may support the targeted reduction in the use of pharmacological interventions, these being classified as a form of chemical restraint and, as such, a last line of treatment in dementia care.[15] Reducing medication use will lower healthcare costs by decreasing both medication expenses and medical care costs associated with adverse effects of medications.

Unscheduled music strategies were administered to patients based on need rather than a prescribed dosage. Recording music used in a log was impractical; concurrently, qualitative analysis of the MS data revealed that music use was higher than recorded as part of the study.

Several factors can increase professional caregivers' likelihood of adopting new training programs into their care practices. The training needs to align with daily staff responsibilities and challenges, and show direct benefits, keeping them motivated to implement what they have learned.[48] Demonstrating that the training leads to measurable improvements can persuade staff of its value.[49] Staff involvement in the development and planning of the implementation will lead to feelings of ownership and commitment.[50] In this study, staff were validated when their suggestions, such as shorter playlists, were incorporated.

Providing tools, resources, and ongoing support can facilitate the transition to adopting a new approach to care.[51] MS with the credentialed music therapist were helpful in clarifying concepts during the intervention period and crucial for maintaining staff motivation and engagement. Staff appreciated the encouragement and responsiveness to feedback, which enhanced their commitment to use MATCH.

Limited technological skills and resources affected the timely use of music, with issues like pairing devices and managing music playback. We recommend providing continuous training sessions and refreshers

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TABLE 4 Summary of MATCH strategies, use of music methods, and type of strategies used for patients during MATCH implementation.

Parameter	Total ($n = 14$)
Average number of MATCH sessions per patient	*8.9 (6.8)*
Total number of MATCH sessions registered[a]	*125*
Reason for using the MATCH strategies	
Reduce agitation	44/125 (35%)
Motivate or energise	6/125 (5%)
Engage/connect	31/125 (25%)
Reminisce	4/125 (3%)
Relax	35/125 (28%)
Assist with personal care	0/125 (0%)
Exercise	0/125 (0%)
Maintain positive mood	5/125 (4%)
Have fun	0/125 (0%)
MATCH intervention	
Mood regulation	32/125 (26%)
Relaxation	52/125 (42%)
Engaging and connecting	36/125 (29%)
Supporting personal care	0/125 (0%)
Movement/exercise	5/125 (4%)
Type of strategies used (more than one possible)	
Listen with music streaming	104/125 (83%)
Listen with CDs	5/125 (4%)
Listen with Radio	0/125 (0%)
Sing	18/125 (14%)
Dance/Movement	7/125 (6%)
Play instruments	10/125 (8%)

Note: Data are presented as mean (SD) for continuous measures and *N* or *n/N* (%) for categorical measures.
Abbreviation: MATCH, Music Attuned Technology Care.
[a]Staff reported not registering all use due to a lack of time. We present here only registered use from overall use.

to ensure staff are up-to-date with the latest practices and troubleshooting techniques.[52] This might include advanced workshops on managing music in challenging situations and addressing specific patient needs, and more hands-on practice sessions in training to support staff gaining confidence in using music devices and playlists effectively.

The staff used all modules during the intervention period, indicating their value in care. The exception was while supporting personal care due to the potential for major BPSD episodes. Possible resistance to care behaviors was justified, as they are the most common type of BPSD in institutional settings,[53] indicating the need for further research to determine how the music intervention can be adapted to better support staff during personal care routines.

Communal settings posed challenges for implementing MATCH strategies due to noise and space constraints. Approaches like using headphones and creating individual music spaces were employed to address these issues, though staff faced difficulties balancing different patient needs and preferences, sharing resources to address issues quickly and minimizing disruptions in patient care. We recommend creating designated areas or using headphones to manage music playback in communal settings, ensuring that individual patient needs are met without disturbing others. Developing flexible approaches for balancing different patient needs and preferences in communal areas, such as rotating music options or portable devices, will allow for more personalized experiences.

This program was implemented in a specific subset of hospital care, which was a specialized long-stay sub-neurobehavioral unit for people with severe BPSD. The MATCH Training used in this study was developed to be tested in residential care settings, and this unit. A range of specific hospital-related challenges were highlighted in this study. The acute nature of the patients' condition meant that staff felt a need to balance risking escalating the patient's agitation with trying out new interventions, resulting in staff tending to refrain from using the MATCH intervention in known scenarios of potential agitation such as ADLs. Future MATCH iterations will focus on a more nuanced ADL modules to support staff in using the intervention for this scenario. Limited family involvement required a strong reliance on the unit's family carer to provide the family's perspective on the intervention. This was ensured by having the family carer as an integral stakeholder throughout the intervention. Time constraints due to emergencies that required all staff on hand to attend the emergency resulted in staff often being unable to complete logging their MATCH intervention promptly. The MS were useful for staff to reflect and retrospectively log their intervention. These adaptations to suit a hospital-care setting will be implemented into future study iterations.

Despite this being a feasibility study based on a small sample, our findings highlight the potential for indirect music therapy[54] to manage symptoms in an acute hospital setting effectively. The trial effects are consistent with those found in the MATCH community care study,[24] and the HOMESIDE study,[19] where family caregivers delivered music strategies. In particular, the HOMESIDE subgroup analysis of those with severe dementia symptoms (a comparable diagnostic profile to this study)[55] suggests that both professional staff and family caregivers can be trained to use music therapeutically with people with severe dementia symptoms, offering a promising, accessible approach to improving patient outcomes in various care settings.

4.1 | Limitations and future research

This is the first MATCH trial within an acute hospital setting and, therefore, was exploratory, lacked a comparative condition, and was based on a small sample. Therefore, all effects reported here should be interpreted with caution. As a pre- to post-trial without a concurrent control, no causal effects can be inferred as it cannot be ruled out that changes that occurred from pre- to post-trial may be due to other

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TABLE 5 Summary of the effect of MATCH strategies on patients.

Parameter	Mood regulation[a] *N* = 32	Relaxation *N* = 52	Engaging and connecting *N* = 36	Movement/exercise *N* = 5
Negative	2/31 (6%)	2/52 (4%)	1/36 (3%)	0/5 (0%)
Neutral	9/31 (29%)	10/52 (19%)	7/36 (19%)	0/5 (0%)
Positive	20/31 (65%)	40/52 (77%)	28/36 (78%)	5/5 (100%)

Note: Data are presented as *n/N* (%) for categorical measures.
Abbreviation: MATCH, Music Attuned Technology Care.
[a]One session was not rated.

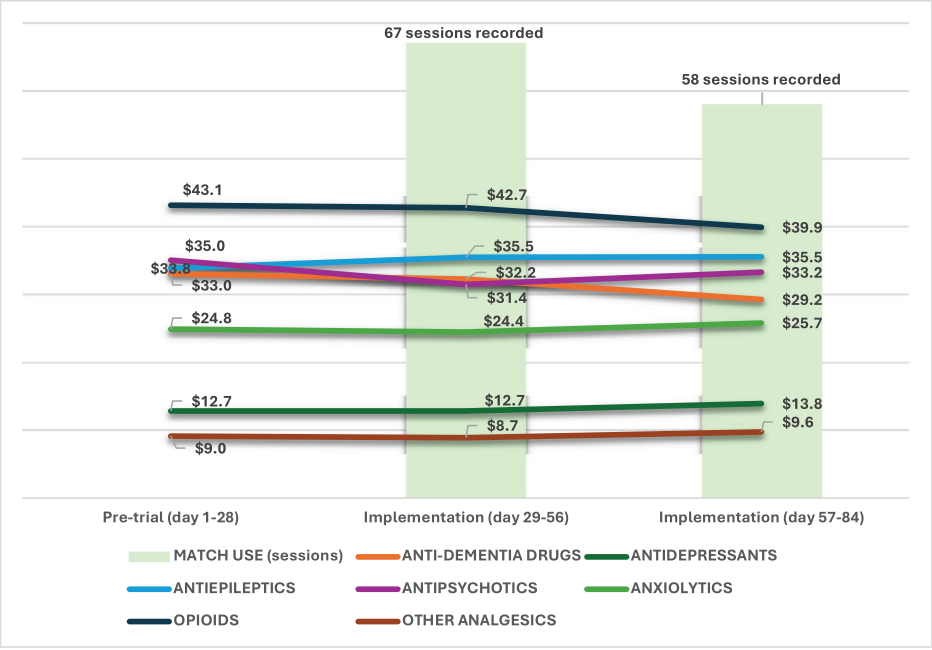

FIGURE 3 Medication costs pre-trial and during implementation. Data presented as mean costs per ATC nervous system subclass in 2024 Australian dollars, and the total number of MATCH sessions registered. The pre-trial period corresponds to the first 28 days of the study, while the implementation period (days 29 to 84) was subdivided into two groups of 28 days to facilitate the comparison to the pre-trial. ATC, anatomical therapeutic chemical; MATCH, Music Attuned Technology Care.

factors. However, the promising results suggest that a larger trial is feasible and warranted. The trial was delivered over the Summer, traditionally when most staff take annual leave, which resulted in a lower proportion of them being able to participate in the research, potentially impacting adherence to the intervention and, in turn, the effect size of reported outcomes.

Most staff who delivered the intervention were born in a country other than Australia. The MATCH training encouraged staff to use patient-preferred music in their intervention. It is envisaged that this person-centered approach would have allowed staff to express their cultural preference and mitigate any potential cultural-sensitivity bias. Using MS with a staff member local to the unit allowed cultural sensitivity to be explored and addressed within the study.

The severity of dementia was characteristic of a specialized dementia unit, and general dementia units may have a broader mix of dementia severity among patients. Therefore, the findings should be interpreted in the context of patients having a diagnosis of severe dementia. Reduced severity of agitation may allow for increased use of music interventions for procedures such as ADLs.[56]

Future research should include monitoring scheduled and unscheduled medication use pre-, during, and post-trial periods with larger samples to determine whether the type and dose of medications change due to including MATCH strategies. Studies that capture the relationship between the effects of medication and music use doses would further aid understanding music's potential to reduce pharmacological treatment.

5 | CONCLUSIONS

Our study found preliminary trends suggesting that training staff to use MATCH in patient care is feasible, accessible, and acceptable and

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could lead to reductions in neuropsychiatric dementia symptoms and medication use. However, practical challenges remain, especially in unstable patient states and during ADLs. Personalized music proved valuable in enhancing person-centered care, although the playlists were sometimes not accurately matched to symptoms. Our music recommender system, which is under development, aims to improve greater personalization of MATCH interventions. MS and continuous support from the credentialed music therapist were crucial for sustaining staff engagement. This emphasizes the importance of ongoing training and feedback mechanisms. Technical issues and communal environment constraints impact the effective use of MATCH strategies. Solutions like personalized playlists and alternative music sources can mitigate these challenges but require careful implementation. The positive emotional impact of using music contributed to a supportive work environment and improved staff morale, highlighting the benefits of music therapy beyond patient care.

AUTHOR CONTRIBUTION

Felicity Anne Baker: Conceptualization, funding, methodology further developed and refined, project management, supervision, interpreted and drafted the results for the quantitative data, formulated the qualitative analysis plan. *Jessica Archbold*: Methodology further developed and refined, implemented the study, including recruitment and data collection. *Tanara Vieira Sousa*: Methodology further developed and refined, project management, verified all underlying data, and estimated medication costs, interpreted and drafted the results for the quantitative data, data curation. *Ajay Castelino*: Methodology further developed and refined, formulated the qualitative analysis plan, analyzed the qualitative data, drafted the initial manuscript with support from Felicity Anne Baker and Tanara Vieira Sousa, managed the trial, prepared figures and tables with support from Sabine Braat, Karen Elaine Lamb and Felicity Anne Baker. *Suzanne Dawson*: Methodology further developed and refined, implemented the study, including recruitment and data collection, formulated the qualitative analysis plan, analyzed the qualitative data. *Peixuan Li*: Methodology further developed and refined, prepared figures and tables with support from Sabine Braat, Karen Elaine Lamb, and Felicity Anne Baker, formulated the statistical analysis plan and applied statistical analyses to the dataset. *Zara Thompson*: Methodology further developed and refined. *Jeanette Tamplin*: Methodology further developed and refined. *Bec Watt*: Methodology further developed and refined, implemented the study, including recruitment and data collection, formulated the qualitative analysis plan. *Karen Elaine Lamb*: Methodology further developed and refined, formal analysis. *Sabine Braat*: Methodology further developed and refined, formal analysis. All authors had access to the data and contributed to interpreting the data, revising the manuscript, and approving the final version. All authors had final responsibility for the decision to submit for publication.

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CONFLICT OF INTEREST STATEMENT

The authors declare no competing financial interests. The findings and conclusions in this report are those of the authors and do not necessarily represent the views or opinions of Aged Care Research & Industry Innovation Australia (ARIIA), Medical Research Future Fund or the University of Melbourne Proof of Concept Fund. Author disclosures are available in the supporting information.

DATA AVAILABILITY STATEMENT

We have opted to not share our data. Our trial includes proprietary technology, and the data is considered commercially sensitive. Sharing such data could jeopardize intellectual property or competitive advantage.

CONSENT STATEMENT

All participants or their legally acceptable representatives signed a written consent form agreeing to participate in the research.

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