TITLE PAGE

1. **Title:** Patients with Life Limiting Illness presenting to the Emergency Department

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4. **Running Title:** ED PATIENTS WITH LIFE-LIMITING ILLNESS

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ABSTRACT

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Objective: Examine characteristics, outcomes and flow for patients over the age of 45 years with a life-limiting illness (LLI) presenting to a regional emergency department (ED).

Methods: Retrospective, observational cohort study of patients with life-limiting illness in an Australian regional ED over a 15-day period. Eligible patients were 45 years of age or older who fulfilled criteria for having a LLI. Data included demographics, diagnosis for current presentation, presence of advance care documentation, LLI category, admission and discharge destination from ED, ED and hospital length of stay and outcome for patients admitted to the acute hospital.

Results: A total of 152 (12%) patients had a LLI. The LLI group were older, had a significantly longer median length of stay in the ED (5.9 [IQR 4.0-8.4] vs 3.9 hrs [IQR 2.5-6.3], $p<0.0001$) and were less likely to leave the ED within 4 hours (26% vs 51.5%, $p<0.0001$). Forty-six per cent of patients with a LLI had some form of advanced care documentation. Patients with a LLI were more likely to require hospital admission. In relation to illness trajectory, the frailty/dementia trajectory group had comparatively the longest ED length of stay with less than 10% leaving the ED within 4 hours. This group were more likely to be discharged to a residential care facility.

Conclusion: A significant proportion of patients 45 years or older had a life-limiting illness which had implications for their length of ED stay and discharge destination.

Key words:

Emergency medicine, life-limiting illness, frailty, cancer, organ failure

INTRODUCTION

The demand on emergency departments (ED) continues to increase across Australia. There were 7.8 million presentations to 287 Australian public hospital emergency departments in the 2016-2017 financial year alone. In addition to an increase in patient numbers, the proportion of older patients is increasing, with 21% of presentations over 65-years of age, and almost 5% of patients aged 85 years or older.¹ Older patients use proportionally more ED services, have complex clinical and psycho-social needs and are more likely to suffer adverse outcomes post-discharge.² In addition, this increase in demand has worsened ED overcrowding which has been associated with increased mortality.³ The four-hour National Emergency Access Target (NEAT) was introduced across Australia in an attempt to improve ED overcrowding.

Patients with life limiting illness (LLI) have complex medical problems, high one-year mortality, and access acute hospitals with increasing frequency in the last year of life.⁴ Life-limiting illness encompasses those illnesses that can be reasonably expected to cause the death of the individual within a foreseeable future. This definition is inclusive of both cancer and non-cancer related illnesses that are expected to shorten an individual's life.⁵ To date the characteristics of emergency care for this cohort of patients has not been described. We hypothesised that patients with LLIs have prolonged emergency department length of stay, high hospital admission rate and poor long-term outcomes. The primary aim of this study was to examine characteristics, outcomes, and flow, for patients with LLI who presented to a major regional hospital emergency department in Australia. The secondary aim was to compare the LLI patient group to non-LLI patients, looking particularly at ED length of stay, discharge destination and NEAT compliance.

METHODS

Setting, design, and participants: We performed a retrospective observational cohort study of patients presenting to the University Hospital Geelong (UHG) emergency department over a 15-day period from 1st to 15th September 2017 inclusive. The UHG is a 450-bed regional tertiary centre, located in southwest Victoria, Australia, and the ED has an annual census of approximately 73,000 attendances per year. September was chosen to reduce bias associated with winter demand or summer tourist influx to the region. The study was approved by the Barwon Health Human Research and Ethics Committee as part of the iValidate research program.

Eligible patients included adults aged 45-years or older who presented to the ED during the 15-day study period. The use of 45-years of age as a cut-off was chosen for several reasons. Firstly, a report from the Australian Bureau of Statistics in 2014 found that the majority (94.5%) of Australians who died in the preceding year were 45 years of age or older with 81% over the age of 65 years, and a further 8.9% and 4.6% aged 55–64 and 45–54 respectively.⁶ It was felt that the majority of patients with a LLI would likely be captured at this age cut-off. Secondly, a single reviewer interrogating all ED and inpatient electronic medical records meant that it was not feasible to review patients less than 45 years of age or for a longer time period. Patients who presented on multiple occasions were included for their initial presentation only. Patients were identified through interrogation of the electronic medical record database. This included detailed analysis of the patient's record when required to identify LLI criteria. If a frailty score had not been formally documented in the medical record, the notes were interrogated to determine whether such a score could be retrospectively calculated. If other LLI criteria were not mentioned anywhere in the electronic record, a LLI was presumed not to be present.

Outcomes: Outcomes included the prevalence of patients with LLI criteria presenting to ED, the characteristics and outcomes of this cohort compared to patients without a LLI, and analysis of association between presence of a LLI and ED length of stay.

Data collection: Data collected for all patients included age, pre-admission accommodation, presence or absence of LLI, LLI category, ED discharge destination and ED length of stay. For the cohort of patients with LLI, additional information collected included gender, admission diagnosis, presence of any existing advance care documentation and hospital length of stay. Advanced care documentation included a formal advanced care plan (ACP) completed in the primary care setting or documentation of goals of care from a previous hospital admission. The presence of LLI was defined using criteria adapted from the UK Gold Standards Framework (GSF) prognostic indicators and the Supportive and Palliative Care Indicators Tool (SPICT), both previously validated in our hospital population.^{4,7,8} In addition, patients were classified into a clinical trajectory group of cancer, organ system failure or frailty/dementia. Full details of the indicators and trajectories are provided in the appendix.

Statistical analysis: All data were collected by one of the study authors (JR). A random sample of 30 (20%) of the LLI patient medical records were checked for accuracy by 2 other authors (MR, SM). In all 30 cases there was agreement regarding the accuracy of LLI selection criteria ie all patients fulfilled adapted criteria from the Gold Standards Framework for presence of a LLI. A sample size of convenience was predicted on an estimated total of 3000 patients presenting over a 15-day period. Statistical analysis was performed using SAS V.9.4. Comparisons between groups were performed using chi-square for equal proportions or Fisher's exact tests where numbers were small. Continuous variables were compared using Wilcoxon rank-sum tests and reported as medians (IQR). Analysis of factors associated with

ED length of stay was performed using multivariable logistic regression with results reported as Odds Ratios (95% CI). Multivariable models were constructed considering all available baseline variables using both stepwise selection and backwards elimination techniques before undergoing a final assessment for clinical and biological plausibility. A two-sided p value of 0.05 was considered to be statistically significant.

RESULTS

A total of 3034 patients presented to the ED over the 15-day period, of which 1286 (42%) were 45 years of age or older and included in the study. Initial review of the 1286 medical records identified 167 potential patients with a LLI. On secondary review of these 167 medical records, 15 patients were excluded due to inadequate data or not fulfilling LLI criteria leaving 152 (12%) patients in the study with a LLI. This is 5% of the all-age total ED presentations over this period.

Life limiting Illness patients

Demographic data of patients with a LLI are presented in Table 1. The mean age (SD) was 76.8 (± 12.9), 50% (n=76) were male, and 46% (n=70) had some form of advanced care documentation. Twenty-six percent (n=44) of patients lived in a residential care facility prior to admission. The most common admission diagnoses for patients with LLI were frailty/fall (19%, n=29), cardiovascular disease (16.5%, n=25), exacerbation of COPD (13%, n=20) and cancer (11%, n=17). Median hospital LOS was 4 days (IQR 2,8).

Comparison by LLI trajectory group is provided in Table 2. Organ failure (42%, n=63) was the most common trajectory group, followed by frailty/dementia (30%, n=46) and cancer (28%, n=43). The cancer trajectory group had the lowest proportion of patients with any advanced care documentation (35%, n=15), the shortest ED LOS (mean (SD) 6 ± 4 hrs, $p < 0.05$), and the highest proportion of patients with an ED LOS less than 4-hours (40%, $p = 0.003$). In contrast the frailty trajectory group had the highest age (mean (SD) 83 ± 11 yrs, $p = 0.0001$), 48% (n=22) had prior advanced care documentation, ED LOS was the longest (mean (SD) 8 ± 4 hrs, $p < 0.05$), and 92% (n=42) of patients exceeded 4-hours in ED. There was no significant difference in hospital admission rate or hospital length of stay between trajectory groups. The frailty/dementia group had a significantly higher ED discharge destination of residential care (frailty/dementia 11% vs organ failure 0% vs cancer 0%, $p = 0.003$) however 75% (33 of 44) of all patients coming to the ED from an aged care facility were in the frailty/dementia trajectory group.

Comparing LLI to non-LLI patients

Comparison of patients with LLI to patients without LLI is provided in Table 3. Patients with LLI were older (mean age (SD) 77 ± 13 years vs 66 ± 14 years, $p < 0.0001$) and had a longer median length of stay in the Emergency Department (5.9 hours [IQR 4, 8] vs 3.9 hours [IQR 3, 6], $p < 0.0001$) than patients without LLI. Patients with LLI were more likely to have an ED LOS of greater than 4 hours (74% vs 48%, $p < 0.0001$). Also, patients with LLI were more likely to require hospital ward admission (65% vs 34%, $p < 0.0001$) or residential care facility as destination (3% vs 1%, $p = 0.003$), and less likely to be admitted to short stay (13% vs 24%, $p = 0.003$) or discharged home (13% vs 38%, $p < 0.0001$).

Comparison of factors associated with ED LOS < 4 hours and > 4 hours

The characteristics and outcomes of all patients with an ED LOS of less than 4 hours is provided in Table 4. Patients with an ED LOS <4hrs were younger (mean age (SD) 64 ± 13 vs 71 ± 14 years, $p < 0.0001$), were significantly less likely to have any LLI (6% vs 17%, $p < 0.0001$), a frailty/dementia LLI trajectory (0.6% vs 6%, $p < 0.0001$) or organ failure trajectory (3% vs 7%, $p = 0.001$). A higher proportion of patients with an ED LOS <4 hours were admitted to short stay (33% vs 14%, $p < 0.0001$) or discharged home (52% vs 18%, $p < 0.0001$).

Multivariate analysis revealed factors associated with ED length of stay greater than 4-hours were frailty/dementia trajectory (OR 6.8, 95% CI 2.4,19.3), organ failure trajectory (OR 2.15, 95% CI 1.2, 3.8) and increased age (OR 1.03, 95% CI 1.02,1.04, $p < 0.0001$) (Table 5).

DISCUSSION

This study describes the characteristics, outcomes and flow of patients with life limiting illness presenting to a major regional hospital emergency department. In this cohort of patients aged 45 years or older, patients with LLI accounted for one in eight of all ED patient attendances, had significantly longer length of stay compared to patients without LLI and were more likely to require hospital admission. Frailty/dementia, organ failure, and age were independently associated with prolonged ED length of stay.

There is little data from an Australian ED setting looking at patients with LLI. This study provides detailed characteristics, prevalence and outcomes of patients with a life limiting illness presenting to a tertiary emergency department. The observation that patients with LLI have prolonged ED LOS and are less likely to be discharged home has important implications for ED workload and flow. In this study, 26% of all patients with a LLI spent 8 hours or more in the ED. Patients with LLI have poor outcomes following admission to acute hospitals, including high one-year mortality and complex care needs.⁷ Early identification of this group of patients, recognition of their complex care needs, and provision of goal-concordant person-centred care could potentially improve time to disposition, patient and family satisfaction, and patient journey overall. This could include early pre-hospital and in-hospital multidisciplinary, person-centred assessment and planning as well as early admission to an acute medical unit when possible.

The impact of patients with LLI on EDs is consistent with existing evidence regarding utilisation of ED for end-of-life care. Data from the Health Round Table describing ED attendances to the study hospital over the 2017 calendar year showed patients in the last 6 months of life spent an average of 11 hours in the ED, and 20 bed days in hospital.⁹ Looking more specifically at individual trajectories, a systematic review and meta-analysis of patients with cancer showed that patients with lung cancer were most likely to present to the ED in the last month of life,¹⁰ while Reeve and colleagues¹¹ reported patients with cancer had a significantly higher rate of health care utilisation in the last 6 months of life. Similarly, a retrospective cohort study showed an increase rate of ED presentation in the last 12 months of life for patients with dementia.¹²

Attendance to ED is common in the last 12 months of life, although there is debate about the concept of 'appropriate' ED presentation for end-of-life care. A study by Cardona-Morrell¹³ suggests non-clinical factors such as poor availability of alternative sites of care or family request account for a significant number of patients with LLI presenting to the ED. Lowthian and colleagues found an increase in non-potentially avoidable GP type ED presentations when examining inappropriate ED presentations in patients over the age of 70 years, with most related to cardiovascular or respiratory illness.¹⁴ A recent Western Australian study demonstrated the receipt of palliative home care nursing significantly reduced the rate of both lower acuity and higher acuity ED presentations.¹⁵ Our study did not address appropriateness of presentation, although it is worth noting a high proportion of patients required hospital admission.

The introduction of the National Emergency Access Target (NEAT) has focussed Australian hospitals on achieving an ED length of stay of less than 4-hours. NEAT was introduced across Australia between 2009-2014 in an attempt to reduce prolonged ED stays which have been shown to adversely impact patient outcomes.¹⁶ Overall three quarters of patients with a LLI did not achieve the NEAT target, with the frailty/dementia group significantly less likely to leave the ED within 4-hours compared with organ failure and cancer trajectory groups. The frailty/dementia trajectory cohort were most strongly associated with prolonged ED length of stay, with the highest proportion of patients requiring hospital admission. This is consistent with existing evidence. A previous ED based study reported frailty predicted ED revisits, hospitalisation, and 6-month mortality.¹⁷ Our study used the Clinical Frailty Score as the frailty assessment tool. The Clinical Frailty Score is well validated^{18,19,20,21,22}, with Clinical Frailty Score, the Frailty Index, and the Frailty Phenotype the most commonly

used frailty tools.²³ A systematic review looking at screening of frail patients in the emergency department found only 4 studies meeting the inclusion criteria and concluded that more randomised clinical trials of frailty screening tools compared to usual care are clearly needed.²⁴

In this study, 46% of patients with a LLI presenting to the ED had some form of advanced care documentation, either a formal primary care generated ACP or documentation of goals of care from a previous admission. The study region has an active community-based ACP programme serviced by the hospital. The prevalence of ACPs in patients with a LLI admitted to the same institution was previously reported as 26%⁷, and only 11% in patients with a LLI referred to ICU.⁸ This study did not examine whether the presence of advanced care documentation affected any of the measured study parameters nor did it document the presence of shared decision-making or engagement in end-of-life care in ED.

There are a number of important limitations to our study. As the study was undertaken at a single tertiary level regional ED and excluded patients under the age of 45 years, this may have reduced the external validity of the study and may have missed younger patients with a LLI. The retrospective, observational nature and single person reviewer also increases the risk of observation (misclassification) bias. If a frailty score had not been formally documented in the medical record, the notes were interrogated to determine whether such a score could be retrospectively calculated. If no documentation of a LLI was found it was assumed that it was not present. Twenty percent of the LLI patient records were further interrogated by two other study authors for accuracy of LLI criteria in an attempt to minimise bias associated with a single data collector. The overall number of patients with an LLI was small which introduces

potential bias and may have meant that some of the subgroup analyses were underpowered. Finally, convenience sampling was utilized and no formal power calculation was performed which may increase the risk of a Type II error and limit the generalisability of the study results.

CONCLUSION

One in eight patients aged 45 years or older presenting to a tertiary Emergency Department had a life limiting illness and these patients were more likely to have a longer ED length of stay and require hospital admission. Pre-hospital and early-hospital multidisciplinary, person-centred interventions should be investigated to streamline care of this vulnerable group of patients.

AUTHOR CONTRIBUTIONS

JR was responsible for all data collection and manuscript review. MR, primary author, NO, contributing author, and SM, contributing author, were responsible for manuscript drafting, review and data interpretation. MB, contributing author, was responsible for data analysis.

COMPETING INTERESTS

None declared

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Table 1: Characteristics of patients with life limiting illness presenting to Emergency Department

Variable	LLI (n = 152)
Mean age (years) (SD)	76.8 ($\pm$ 12.9)
Male	76 (50)
Advanced care documentation	70 (46.1)
Pre-Hospital Accommodation	
Home	123 (73.7)
Residential Care Facility	44 (26.3)
Admission Diagnosis	
Exacerbation COPD	19 (12.5)
Respiratory	2 (1.3)
Stroke / Neurological disease	3 (2.0)
Infection	14 (9.2)
Cancer/Cancer related problem	16 (10.5)
Fracture/dislocation	14 (9.2)
Cardiovascular Disease	25 (16.5)
Renal Failure	2 (1.3)
Gastrointestinal Disease	15 (9.9)
Frailty/Fall	29 (19.1)
Other	13 (8.5)
Median hospital LOS (days) [IQR]	4 [2,8]

Data are shown as number (percentage) or as stated

Table 2: Interventions and outcomes for patients with LLI presenting to ED by trajectory

Variable	Cancer	Organ failure	Frailty / dementia	P-value
Number	43	63	46	
Mean age (years) (SD)	71.2 ($\pm$ 11.5)	76.1 ($\pm$ 13.3)	83.1 ($\pm$ 11.1)	0.0001
Male	22 (51.2)	29 (46.0)	25 (54.4)	
Advanced care documentation	15 (34.9)	33 (52.4)	22 (47.8)	0.2
Mean ED Length of stay (hours) (SD)	5.7 ($\pm$ 3.9)	6.9 ($\pm$ 3.9)	7.9 ($\pm$ 4.2)	<0.05
0-4 hours	17 (39.5)	17 (27)	4 (8.7)	0.003
4-8 hours	17 (39.5)	29 (46)	28 (60.9)	0.1
8-12 hours	6 (14)	10 (15.9)	8 (17.4)	0.9
>12 hours	3 (7)	7 (11.1)	6 (13)	0.6
ED discharge destination				
ED Short Stay Unit	4 (9.3)	7 (11.1)	9 (19.6)	0.3
Ward / RAPU	27 (62.8)	46 (73)	26 (56.5)	0.2
Critical Care	0 (0)	1 (1.6)	0 (0)	0.5
Residential Care Facility	0 (0)	0 (0)	5 (10.9)	0.003
Other Hospital	1 (2.3)	2 (3.2)	3 (6.5)	0.6
Home	10 (23.3)	7 (11.1)	3 (6.5)	0.06
Died	1 (2.3)	0 (0)	0 (0)	0.3
Median hospital LOS (days) [IQR]	3.0 [1.0,5.0]	4 .0[1.5, 8.5]	3.0 [1.0,7.0]	0.6

1. Abbreviations: RAPU = Rapid Assessment and Planning Unit
2. Data are shown as number (percentage) or as stated

Table 3: Comparison of flow and outcomes of patients presenting to ED with and without LLI

Variable	LLI (n=152)	No LLI (n=1134)	P-value
Mean age (years) (SD)	76.8 ($\pm$ 12.9)	65.9 ($\pm$ 13.6)	<0.0001
Median ED Length of stay (hours) [IQR]	5.9 [4.0,8.4]	3.9 [2.5, 6.3]	<0.0001
0-4 hours	39 (25.7)	584 (51.5)	<0.0001
4-8 hours	73 (48.0)	378 (33.3)	<0.0001
8-12 hours	24 (15.8)	86 (7.6)	0.001
>12 hours	16 (10.5)	86 (7.6)	0.2
ED discharge destination			
ED Short Stay Unit	20 (13.2)	272 (24)	0.003
Ward / RAPU	99 (65.1)	385 (34)	<0.0001
Critical Care	1 (0.7)	22 (1.9)	0.3
Residential Care Facility	5 (3.3)	8 (0.7)	0.003
Mental Health	0 (0)	5 (0.4)	1.00
Other Hospital	6 (3.9)	15 (1.3)	0.02
Home	20 (13.2)	425 (37.5)	<0.0001
Died	1 (0.7)	2 (0.2)	0.3

1. Abbreviations: RAPU = Rapid Assessment and Planning Unit

2. Data are shown as number (percentage) or as stated

Table 4 Comparison of patients with Emergency length of stay <4 hrs to >4 hrs

Variable	<4 hours (n=620)	4 or more hours (n=666)	P-value
Mean age (years) (SD)	63.6 ($\pm$ 13.2)	70.5 ($\pm$ 13.9)	<0.0001
LLI status			
Any	38 (6.1)	114 (17.1)	<0.0001
Cancer	17 (2.7)	26 (3.9)	0.09
Frailty/dementia	4 (0.6)	42 (6.3)	<0.0001
Organ failure	17 (2.7)	46 (6.9)	0.001
ED discharge destination			
ED Short Stay Unit	202 (32.6)	90 (13.5)	<0.0001
Ward / RAPU	73 (11.8)	411 (61.7)	<0.0001
Critical Care	11 (1.8)	12 (1.8)	1.0
Residential Care	3 (0.5)	10 (1.5)	0.07
Mental Health	4 (0.6)	1 (0.2)	0.2
Other Hospital	3 (0.5)	18 (2.7)	0.002
Home	324 (52.3)	121 (18.2)	<0.0001
Death	0 (0)	3 (0.5)	0.3

1. Abbreviations: RAPU = Rapid Assessment and Planning Unit

2. Data are shown as number (percentage) or as stated

Table 5: Multivariate analysis of factors associated with ED LOS >4hrs

Variable	OR (95% CI)	P-value
Age	1.03 (1.02-1.04)	<0.0001
LLI trajectory (vs no LLI)		
Cancer	1.38 (0.73,2.60)	0.0002
Frailty	6.79 (2.39, 19.33)	
Organ Failure	2.15 (1.20, 3.84)	

Clinical Frailty Scale
<p>1 Very Fit – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.</p>	<p>7 Severely Frail – Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).</p>
<p>2 Well – People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally, e.g. seasonally.</p>	<p>8 Very Severely Frail – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.</p>
<p>3 Managing Well – People whose medical problems are well controlled, but are not regularly active beyond routine walking.</p>	<p>9 Terminally Ill – Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise evidently frail.</p>
<p>4 Vulnerable – While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "slowed up", and/or being tired during the day.</p>
<p>5 Mildly Frail – These people often have more evident slowing, and need help in high order IADLs (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.</p>	<p>Scoring frailty in people with dementia</p> <p>The degree of frailty corresponds to the degree of dementia. Common symptoms in mild dementia include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.</p> <p>In moderate dementia, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.</p> <p>In severe dementia, they cannot do personal care without help.</p>
<p>6 Moderately Frail – People need help with all outside activities and with keeping house. Inside, they often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing.</p>	

EMM_13409_clinical frailty scale .jpg

Appendix 1: Life limiting illness indicators definition and classification

Life limiting illness indicator	Definition
Cancer	Metastatic or not amenable to treatment
Organ failure	
Heart failure	NYHA stage III/IV or reduced exercise tolerance
Chronic obstructive pulmonary disease	Disease assessed as severe (eg FEV1 <30% predicted) or long-term oxygen therapy / home oxygen or shortness of breath at 100m on level ground
Renal disease	Stage 5 chronic renal failure or long-term dialysis or not for dialysis or eGFR less than 15 ml/min
Neurological disease	Parkinson's disease with assistance with ADLs, or falls or difficulty swallowing, multiple sclerosis with dysphagia, motor neurone disease with rapid decline or episode of aspiration pneumonia, stroke (minimal conscious state or dense hemiparesis)
Frailty	
Frailty	Clinical frailty score 6 to 9
Dementia	No consistent meaningful conversation or needs assistance with ADLs
Nursing home	From nursing home

Appendix 2: Clinical Trajectory Group

Clinical Trajectory Group	Definition
1. No life limiting illness	Patients without an LLI
2. Cancer	Patients with cancer as one of their LLI indicators
3. Frailty	Non-cancer patients with any of frailty, dementia, or nursing home accommodation as an LLI Indicator
4. Organ failure	Non-cancer and non-frailty patients with heart failure, renal disease, COPD or neurological disease as an LLI indicator

Appendix 3: Clinical Frailty Scale

Original source: Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell I, Mitnitski A. A global clinical measure of fitness and frailty in elderly people. *CMAJ* 2005 Aug 30;173(5):489-95

TITLE PAGE

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