Abstract

Objective(s): To assess the feasibility of frailty assessment of older adults presenting to the emergency department (ED) of a metropolitan hospital in Australia; to define the frailty of this population using the Clinical Frailty Scale (CFS); and to determine whether frailty at triage is associated with patient outcomes.

Methods: A prospective cohort study was conducted at The Prince Charles Hospital (Brisbane, Australia) in 2017. Outcome data were retrospectively collected.

Results: In total, 945 adults aged ≥75 years presented to the ED during the one-month study. Among them, 712 (75.3%) had a CFS score assigned at triage and 345 (48.5%) were frail (CFS ≥5). Frailty score at ED presentation was independently associated with admission to hospital, length of stay and inpatient mortality.

Conclusions: Frailty assessment at triage was feasible and identified vulnerable patients at presentation to the ED. Frailty assessment may facilitate improved patient care through targeted, multidisciplinary interventions.

Key words: ageing, emergency medicine, emergency ward, frailty, mortality

Impact Statement

This research demonstrated that frailty assessment of older adults by triage nurses in the emergency department is feasible and valid (as demonstrated by significant associations with short-term adverse outcomes). Emergency departments in Australia should consider implementing this approach to frailty assessment. How best to utilise the information gleaned from this assessment requires further investigation.

Introduction

Older adults are a core remit of hospital emergency departments (ED). According to the Australian Institute of Health and Welfare, 20% of presentations to Australian EDs in 2015–2016 were patients aged 65 years and older [1]. However, the number of older adults presenting to the ED is likely to increase due to population ageing. Indeed, the proportion of the Australian population aged over 65 years is anticipated to increase from 15% to approximately 23% by 2050 [2]. Therefore, optimising the care of older adults presenting to the ED is of growing interest.

Some of the older patients presenting to the ED will also be frail. Despite the lack of universal definition, frailty is generally accepted to be an expression of an individual's reduced capacity to respond to stressors, rendering them vulnerable to adverse outcomes [3, 4]. Indeed, there is a mounting body of evidence suggesting that frailty is linked with poor patient outcomes [5-13]. As frail older patients typically require more intensive management, they place a greater demand on health system resources [3, 4]. Measuring frailty in the ED setting may help to improve the management and outcomes of these patients [14].

In 2017 the Metro North Hospital and Health Service (MNHHS), Brisbane, launched the 'Care of the Frail Older Person' project. This program of initiatives aimed to enhance the delivery of person-centred care to frail inpatients. Early identification of frailty was thought to be a crucial step in the overall plan to implement targeted interventions for this population in the MNHHS.

Whilst many frailty assessment tools exist in clinical practice [7], their utility in the acute medical setting has been questioned [11, 15, 16]. The two most commonly cited approaches to frailty assessment are Fried's phenotype model and Rockwood's accumulated deficits model [3-5]. Fried and colleagues defined frailty as the presence of three or more of the following variables: unintentional weight loss, low energy expenditure, self-reported exhaustion, slow gait speed and weak grip strength [3]. Meanwhile, Rockwood's accumulated deficit model defined frailty as the number of health deficits present (signs, symptoms, abnormal laboratory results, disabilities and disease states) relative to the total number of deficits assessed [4, 17]. Both tools have predictive validity for a range of outcomes in hospital inpatients, including prolonged hospital admission, inpatient mortality and new institutionalisation [6, 8, 9, 12, 18]; however, their use in the ED may be clinically

impractical. Indeed, the five physical items of Fried's model are not readily assessed in the acutely unwell older adult and collecting a minimum of 30 variables required for Rockwood's model is a daunting task in the ED setting where clinicians have limited time. Overall, the ideal tool for ED frailty assessment would be time efficient, based on readily available clinical information and able to be administered by nursing or non-medical staff in even the most unwell patients with minimal training required. At the present time, there is a paucity of studies validating frailty assessment tools in the ED setting, particularly in Australia.

For the 'Care of the Frail Older Person' project, the Canadian Study of Health and Aging Clinical Frailty Scale (CFS) [4] was considered to meet the 'ideal' criteria most effectively. Rockwood and colleagues developed the CFS using the accumulated deficit model of frailty, with each increment in the score reflecting a greater number of health problems and, therefore, a greater level of frailty. The CFS is a clinical judgement tool that does not require multidisciplinary allied health staff assessments, specialist input or inclusion of multiple clinical variables, making it an attractive tool to implement in the ED setting.

The current study aimed to assess the feasibility of assessing frailty using the CFS in an ED of an Australian metropolitan hospital, to define the frailty of older adults presenting to the ED, and to determine whether CFS scores at triage are associated with patient outcomes, including admission rates, length of hospital stay and inpatient mortality.

Methods

This prospective cohort study is a component of the 'Care of the Frail Older Person' project.

Study setting

The study was conducted at The Prince Charles Hospital, a tertiary referral hospital located approximately 10 km from the centre of Brisbane, Australia. The Prince Charles Hospital is part of the MNHHS, which includes five hospitals delivering services to an estimated population of 900,000 people in South East Queensland, Australia.

Study sample

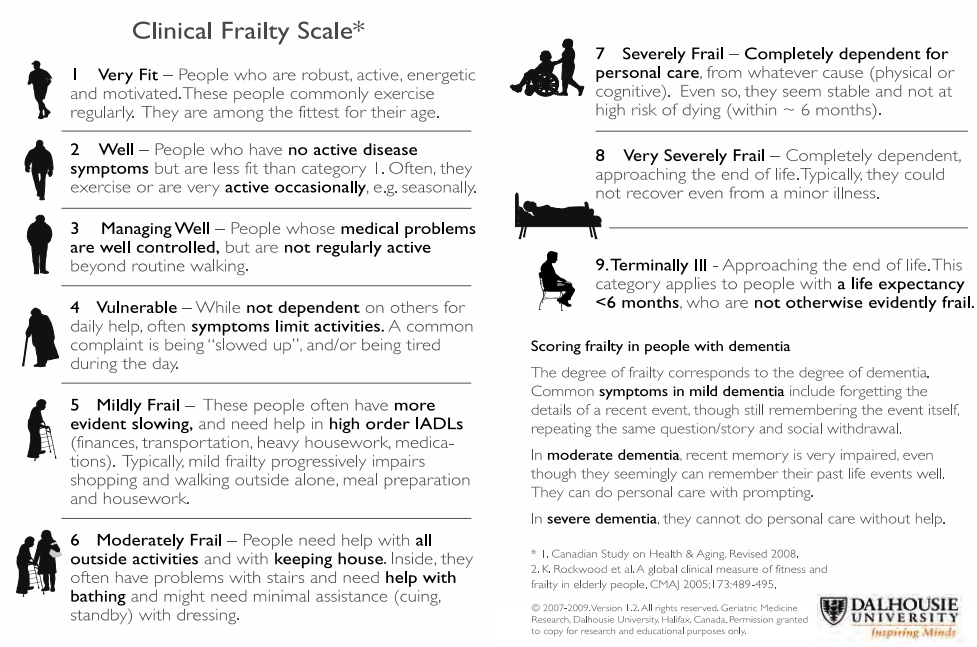
The study included adults aged 75 years and older that presented to the ED during September 2017. Even though a proportion of 'young-old' patients are frail, those aged 75 years and over were thought to be a more manageable cohort for the 'Care of the Older Person' project. Only

a patient's first presentation to the ED during that month was evaluated. Patients without a frailty assessment at triage were excluded from analyses.

Frailty assessment

The CFS is a quantitative tool that utilises clinical descriptors (referencing co-morbidity burden, mobility issues, energy levels and functional impairments) and pictures to allow the assessor to attribute a score ranging from 1 ("very fit") to 9 ("terminally ill") (**Figure 1**). It has been validated as a predictor of mortality and institutionalisation in community-dwellers, as well as inpatients [4, 22]. ED nursing staff were introduced to the CFS at commencement of the 'Care of the Frail Older Person' project, but did not receive specific training prior to this study.

Figure 1: Clinical Frailty Scale (Canadian Study on Health and Aging, Revised 2008) **[4]**



Study design

At triage, a nurse assessed patients using the CFS, regardless of their place of residence, mode of presentation or nature of illness. The score was recorded on the Emergency Department Information System (EDIS). Patient's received standard ED and inpatient care.

Demographic data, including age, gender, place of residence and mode of presentation to ED, were collected retrospectively from the EDIS. Patient outcome data (including admission

status following emergency presentation, place of admission, length of admission and inpatient mortality) were collected from inpatient electronic records.

Statistical analyses

CFS scores were divided into three clinically relevant sub-groups: CFS 1–4 (non-frail); CFS 5–6 (mild-to-moderately frail) and CFS 7–9 (severely frail). This categorisation is consistent with previous studies utilising the CFS in inpatients [23]. Parametric and non-parametric statistics were used, as appropriate, to compare differences in age, gender, length of stay (LOS), admission rates and inpatient mortality between the CFS groups. Linear (LOS) or logistical regression (mortality, hospital admission) were used to investigate associations between age, sex, CFS category and adverse outcomes. Univariate analysis was performed first, and if justified, variables with $p<0.01$ were included in the subsequent multivariate analysis to produce the final model. A p-value <0.05 was considered statistically significant. All statistical analyses were performed using Stata (StataCorp version 14).

Ethics approval

Approval to conduct this research was granted by The Prince Charles Hospital Human Research Ethics Committee (HREC/18/QPCH/223).

Results

Between 1st September 2017 and 1st October 2017, there were 7620 total presentations to ED at The Prince Charles Hospital. Of these, 945 were first presentations of patients aged 75 years and over, and 712 (75.3%) had a CFS score recorded at triage. The demographics of the 712 patients included in this study are summarised in **Table 1.**

Table 1: Characteristics of the study cohort

Variable	Total (n = 712)
Mean age, years (SD)	85.6 (5.6)
Sex, n (%)	
Male	312 (43.8)
Female	400 (56.2)
Place of Residence, n (%)	
RACF	109 (15.3)
Own home	603 (84.7)

The characteristics of the study population according to CFS group are presented in **Table 2**. Three hundred sixty-seven (51.5%) patients were non-frail, 252 (35.4%) were either mild or moderately frail, and 93 (13.1%) were severely frail. The frailty groups differed significantly with respect to mean age ($p < 0.001$), with the frailest group being the oldest. The frailty groups also differed significantly with respect to sex ($p < 0.001$); with a predominance of females in the mild-to-moderately frail group (CFS 5–6).

Table 2: Patient characteristics according to Clinical Frailty Score

	CFS 1–4 (n = 367)	**CFS 5–6 (n = 252)**	**CFS 7–9 (n = 93)**	**p-value**
Mean age, years (SD)	83.2 (5.1)	85.8 (5.9)	87.1 (5.5)	p < 0.001
Female sex, n (%)	181 (49.3)	179 (67.5)	49 (52.7)	p < 0.001

The outcomes according to CFS group are presented in **Table 3**. Admission rates and mean length of stay varied according to CFS group ($p=0.001$ and $p<0.001$, respectively). CFS group was also associated with inpatient mortality rates ($p<0.001$). Thirty-one patients died during admission: five of these were non-frail (CFS 1–4), 11 were mild-to-moderately frail (CFS 5–6) and 15 were severely frail (CFS 7–9).

Table 3: Patient outcomes according to Clinical Frailty Score

	CFS 1–4 (n = 367)	**CFS 5–6 (n = 252)**	**CFS 7–9 (n = 93)**	**p-value**
Admission, n (%)	171 (46.59)	139 (55.16)	62 (66.67)	p = 0.001
Length of stay, days (SD)	2.86 (7.75)	3.98 (10.43)	4.7 (11.15)	p < 0.001
Inpatient mortality, n (%)	5 (1.36)	11 (4.37)	15 (16.13)	p < 0.001

Logistic regression analyses are presented in **Table 4.** Compared with a non-frail patient (CFS score 1–4), a patient with a CFS score of 5–6 was 1.4 times more likely to be admitted (odds ratio [OR] = 1.41, 95% Confidence Interval [CI] 1.02–1.95, p = 0.037) and a patient with a CFS score of 7–9 was 2.3 times more likely to be admitted to hospital from ED (OR = 2.29, 95% CI 1.42–3.70, p = 0.001). Neither age nor sex were associated with admission rates.

In multivariate analysis, compared with non-frail patients of the same age, a moderately frail patient (CFS 5-6) was 2.8 times more likely to die as an inpatient (OR = 2.79, 95% CI 0.94-

8.27, p = 0.065) and a severely frail patient was 11 times more likely to die as an inpatient (OR = 11.02, 95% CI 3.79-31.20, p<0.001). In this model, age was not an independent predictor of inpatient mortality once frailty was considered.

Table 4: Logistic regression analysis (univariate and multivariate) for admission to hospital and inpatient mortality.

Outcome	Variable	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Admission	Sex	1.07 (0.80-1.44)	0.649	-	-
	Age, years	1.01 (0.98 – 1.04)	0.510	-	-
	Frailty*				
	CFS 5-6	1.41 (1.02 – 1.95)	0.037	-	-
	CFS 7-9	2.92 (1.42 – 3.70)	0.001	-	-
Inpatient mortality	Sex	1.67 (0.78 – 3.61)	0.189	-	-
	Age, years	1.10 (1.04 – 1.17)	0.002	1.06 (1.00-1.14)	0.061
	Frailty*				
	CFS 5-6	3.30 (1.13 – 9.63)	0.029	2.79 (0.94 – 8.27)	0.065
	CFS 7-9	13.92 (4.91 – 39.44)	<0.001	11.02 (3.79– 32.10)	<0.001

* reference group is CFS 1-4

Linear regression analysis showed that neither, age, sex or frailty score were associated with LOS.

Discussion

The 'Care of the Frail Older Person' project was rolled out by MNHHS to improve the care of vulnerable older patients in hospital. A 2018 scoping review indicated that identification of frail older adults in the ED and inpatient wards may lead to improved care [24]. Thus, the current study, focusing on identification of frail elderly, was one of the first initiatives of the project.

We found that almost half (48.5%) of measured older adults aged 75 years and older presenting to the ED were frail, with a CFS score of five or more. We also found that a higher frailty score at presentation to the ED indicated that an elderly patient was more likely to require admission to hospital and was more likely to die during their admission. These results are consistent with the international literature. For example, a large retrospective observational study from the United Kingdom demonstrated that, after adjustment for

potential confounders (i.e., age, gender, comorbidity, history of dementia and/or current cognitive concern), the CFS score upon ED presentation was an independent predictor of inpatient mortality (OR = 1.60, 95% CI: 1.48–1.74, $p < 0.001$) and transfer to a geriatric ward (OR = 1.33, 95% CI: 1.24–1.42, $p < 0.001$) [27]. Significant differences in the magnitude of the odds ratio between this study and the current study may be due in part to differences in the extent of adjustment for potential confounding variables.

Our study found that mean length of stay differed between frailty groups, with a signal for longer duration with higher CFS score. However, this association was not found on regression analysis. Similar to our results, a Canadian prospective cohort study showed that CFS score on admission to an acute medicine unit was associated with mean length of stay in an acute medical ward [13]. A relationship between increasing frailty and prolonged length of stay (greater than or equal to 10 days) was identified via logistic regression in another study (OR = 1.19, 95% CI: 1.14–1.23, $p < 0.001$) [27].

A study undertaken at Liverpool Hospital in New South Wales in 2015 also found that frailty (as measured by the CFS) was an independent predictor of in-hospital mortality, new nursing home placement and length of stay [5]. Whilst the outcomes of this study were similar to ours, there were significant differences in the study methods. For example, Basic and Shanley [5] focussed on patients admitted with geriatric syndromes with a frailty assessment performed by the treating geriatrician and multidisciplinary team. The current study included all patients over the age of 75 years regardless of their presenting problem or the inpatient team they were admitted under. Furthermore, assessment was conducted by a triage nurse only. To the best of our knowledge, this is the first Australian study to examine the relationship between frailty assessment at ED triage and adverse outcomes.

The results of the current study provide further evidence for the validity of the CFS in the acutely unwell older population. However, it is unclear whether it is, overall, the ‘best’ tool for this setting. In 2015, a systematic review identified a lack of geriatric screening tools available for discriminating between low-risk and high-risk patients in the ED setting [25]. Different assessment tools have been developed in an attempt to meet this clinical need, albeit with varying success. For example, the Survey of Health, Ageing and Retirement in Europe Frailty Instrument (SHARE-FI) in the ED was shown to have limited predictive validity in terms of mortality (OR = 0.89, 95% CI: 0.58–1.38, $p = 0.614$) [26]. However more recently,

the Emergency Department Frailty Index (ED-FI), developed as part of a multinational prospective cohort study, was associated with a number of adverse outcomes, including admission to hospital (OR = 1.09, 95% CI: 1.02-1.15), prolonged length of stay (OR = 1.18, 95% CI: 1.06-1.31) and in-patient mortality (OR = 1.57, 95% CI: 1.39-1.79) [6]. Unlike the current study, the ED-FI relied on 24 variables obtained from a prior brief geriatric assessment entered into the interRAI ED-Contact Assessment tool [6]. Whilst the ED-FI shows promise as an important tool for assessing frailty in the emergency setting, it relies on software systems that are not readily available in all Australian EDs. Overall, comparison studies of frailty assessment tools in the ED are lacking.

Importantly, the current study demonstrated the feasibility of incorporating the CFS into the nursing assessment at triage. Integration of frailty assessment into standard care without the requirement of additional resources is a benefit of the CFS. In a one-month period, approximately 75% of the target population was assessed at triage using the CFS. It is unclear whether the patients without CFS scores differed significantly from the participants with respect to frailty, demographic characteristics or acute illness. Recent data collection at the same site has demonstrated an improvement in the assessment rate (to 86.4% of adults aged 75 years and over), which suggests that non-assessment during the study period may, to some extent, have been due to suboptimal uptake of the CFS early in the 'Care of the Frail Older Person' project.

In community-dwelling adults, frailty appears to be influenced by targeted, multidisciplinary interventions [28-30]. Early identification of frailty in hospital inpatients may enable implementation of a range of interventions, including for example, early assessment by allied health staff, early mobilisation strategies, referral for comprehensive geriatric assessment and perhaps direct admission under a geriatric service. Our group are developing and evaluating new models of care in the frail older adult. Nevertheless, further research is required to determine which early interventions are the most effective in improving outcomes among frail older adults. Importantly, it is essential to ensure that the identification of older frail adults in the ED does not lead to inappropriate withdrawal or withholding of care due to the misconception that frailty is a permanent or terminal condition.

The results of this study must be considered within the context of its limitations. Firstly, we did not evaluate the inter-rater reliability of the assessment. Given the subjective nature of the

CFS, the large number of potential nurse assessors and the variable exposure of those nurse assessors to principles of geriatric assessment, inter-rater reliability may have been poor. However, the relationship between frailty and adverse outcomes in the present study suggests that frailty assessment was overall robust. Secondly, patients that did not have a frailty assessment at triage were not examined in this study and, as a result, potential bias in the study results was not explored. Finally, we were unable to account for the potential impact of other patient factors, such as the severity of acute illness. Indeed, a previous study showed that frailty and acute illness severity among older patients presenting to the ED were independently associated with inpatient mortality [23].

Conclusion

As the population ages, the prevalence of frailty in Australasia will rise. Therefore, it is foreseeable that an increasing proportion of older patients presenting to the ED will be frail. In this preliminary study, we found that frailty assessment of older adults at triage was not only feasible but also identified patients vulnerable to adverse outcomes in hospital. We propose that early identification of frailty could lead to implementation of early, multidisciplinary interventions. Further prospective studies are required to guide development of effective and efficient models of care for frail older people in hospital.

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Conflict of Interest

The authors declare no conflicts of interest.

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