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## Research paper

# The association between clinical frailty and walking speed in older hospitalized medical patients: A retrospective observational study



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## ABSTRACT

**Introduction:** This study aims to further evaluate the use of the clinical frailty scale (CFS) by assessing its correlation with usual walking speed (UWS) in older medical inpatients.

**Methods:** Retrospective observational study in an English tertiary university hospital. We analysed all admission episodes of people admitted to the Department of Medicine for the Elderly wards during a 3-month period. We excluded those who died or had a CFS score of 9, indicating terminal illness. The CFS was recorded on admission and 6 meter UWS was measured on the day of hospital discharge. Other variables collected were: age, sex, the four-item version of the Abbreviated Mental Test (AMT4), and the Emergency Department Modified Early Warning Score.

**Results:** There were 1022 patients admitted over the study period, of which 741 met inclusion criteria and had both CFS and walking speed data available. Five hundred and seventy were able to mobilise at least 6 m. The median UWS was 0.33 (0.21–0.50) m/s. Logistic ordinal regression showed that lower CFS, being male and higher score in the AMT4 were associated with higher odds of being in a higher walking speed category (odds ratio for CFS after covariable adjustment: 0.57 [95% CI, 0.50 to 0.65]).

**Conclusions:** We observed a strong association between higher admission CFS and lower discharge UWS. This association was not explained by variation in age, sex, presence of cognitive impairment or illness acuity and provides further evidence that the CFS maybe a valid measure of frailty in acute clinical settings.

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## 1. Introduction

Frailty is a state of increased vulnerability to poor resolution of homeostasis after a stressor, such as an illness or fall necessitating an admission to hospital [1]. In our hospital, a local Commissioning for Quality and Innovation (CQUIN) hospital payment incentive scheme ([http://www.institute.nhs.uk/commissioning/pct\\_portal/cquin.html](http://www.institute.nhs.uk/commissioning/pct_portal/cquin.html)) implemented in 2013 mandated that all patients aged 75 years or older admitted through the emergency pathway be screened for frailty using the Clinical Frailty Scale (CFS) within

72 hours of admission. The admitting team (usually the junior doctor) score the patient making a judgment about the degree of a person's baseline frailty (i.e. prior to the onset of the acute illness triggering the admission) based on information from a formal clinical assessment [2]. The scoring of the CFS is based on a global assessment of patients' comorbidity symptoms, cognition and their level of physical activity and dependency on activities of daily living ([http://geriatricresearch.medicine.dal.ca/clinical\\_frailty\\_scale.htm](http://geriatricresearch.medicine.dal.ca/clinical_frailty_scale.htm)). The possible scores are: 1 (very fit), 2 (well), 3 (managing well), 4 (vulnerable), 5 (mildly frail), 6 (moderately frail), 7 (severely frail), 8 (very severely frail) and 9 (terminally ill).

Walking speed has been described as the 'sixth vital sign' in older adults [3]. It is a well-validated, sensitive and robust tool [4]. Usual walking speed (UWS) has been shown to correlate with daily ambulatory activity [5], future health status [6], functional decline [7], and the physical frailty phenotype [8]. The relationship between UWS and the CFS has been less studied.

**Abbreviations:** AMT4, 4-item version of the Abbreviated Mental Test; CQUIN, Commissioning for Quality and Innovation; CFS, Clinical Frailty Scale; DME, Department of Medicine for the Elderly; ED-MEWS, Emergency Department Modified Early Warning Score; IQR, Inter-quartile range; SD, Standard deviation; UWS, Usual walking speed.

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In hospitalised older adults, frailty as measured by the CFS has been shown to predict mortality, length of stay and functional trajectories [9–12]. We aimed to further evaluate the clinical use of the CFS by assessing its correlation with UWS at discharge.

## 2. Method

### 2.1. Setting and participants

This was a retrospective observational study in a large tertiary university NHS hospital in the United Kingdom. We analysed all admission episodes of people admitted to the Department of Medicine for the Elderly (DME) wards between 2nd May and 26th Aug 2016. Patients who died during hospital admission and patients with a frailty score of 9 were excluded as it is felt that 'terminal illness' can be independent from frailty and could therefore bias the results.

### 2.2. Measures

Routinely collected clinical data was obtained from the hospital electronic medical records. All measures used in this service evaluation audit were routinely collected as part of normal clinical care.

As mentioned above, the CFS is routinely scored on admission to hospital in patients aged 75 or more years. UWS over 6 m is routinely measured by DME physiotherapist on day of discharge from hospital. The patient is asked to walk down a corridor at their own pace, starting approximately 1–2 m before the 6 m course, marked out along the corridor and stopping approximately 1–2 m after the end of the course, to avoid acceleration or deceleration interfering with the UWS measurement [13]. Patients walk with their usual walking aid.

Other variables routinely collected were: age, sex, the Emergency Department Modified Early Warning Score (ED-MEWS, highest recorded in the ED), and the four-item version of the Abbreviated Mental Test (AMT4) [14]. ED-MEWS scores are routinely collected by nursing staff in ED, and are considered as a measure of acute illness severity [15]. The version of the ED-MEWS that we use scores from 0–15 and components include: heart rate; respiratory rate, systolic blood pressure; degree of alertness and body temperature [9]. The usual trigger for escalation (i.e. immediate referral to doctor for clinical review) is 4 or more points. The 4-item version of the Abbreviated Mental Test (AMT4) [14] is routinely collected in our center as part of a Dementia/Delirium CQUIN, which aims at detecting cognitive impairment on admission to hospital. The AMT4 consists of four questions regarding the patient's age, date of birth, the place that the person is currently located, and the current year.

### 2.3. Statistical analyses

Anonymised data was analysed with IBM SPSS Statistics (version 22) software. Descriptive statistics were given as count

(with percentage) or mean (with standard deviation [SD]). For continuous variables with a non-normal distribution, median values with inter-quartile ranges (IQR) were used. UWS was divided into 5 ordinal groups; the first group consisted of those unable to mobilise 6 m, the 4 other groups were defined by the inter-quartile range of the walking speed data, with group 2 being the slowest and group 5 the fastest. The groups are referred to as 'walking quintiles' in the text.

The relationship between CFS and UWS was assessed by logistic ordinal regression, using the walking quintiles as the dependent variable. Other covariables in the model were: age, sex, ED-MEWS and AMT4.

The level of statistical significance was set at  $P < 0.05$ , and  $P < 0.1$  was considered as statistical trend.

### 2.4. Ethics approval

This Service Evaluation Audit was registered with our center's Safety and Quality Support Department (Project Register Number 3962). Formal confirmation was received that approval from the Ethics Committee was not required.

### 2.5. Declaration of sources of funding

Permission to use the CFS was obtained from the principal investigator at Geriatric Medicine Research, Dalhousie University, Halifax, Canada. Funding was not required for this study.

## 3. Results

There were 1022 patients admitted over the study period. Seventy-eight patients died during admission, 62 patients had missing CFS data, and 4 had a CFS score of 9 leaving a total of 878 patients for analysis. Patient characteristics are given in Table 1. Due to the small populations in CFS groups 1, 2, and 8, patients with a score of 1 or 2 were grouped together (i.e. 'very fit' and 'well') and those with a score of 7 or 8 were grouped together (i.e. 'severely frail' and 'very severely frail').

Walking speed assessments were carried out on 741 patients (84.4%) on the day of discharge; of the 137 missing, 6 were not assessed as were receiving end of life care, 4 declined, and the remaining 127 patients were discharged before the physiotherapist could carry out the assessment. Of the 741 with day of discharge walking assessment, 570 (77%) were able to mobilise at least 6 m. The median UWS was 0.33 (0.21–0.50) m/s. The number of patients able to mobilise 6 m and median (IQR) walking speed for each CFS category are reported in Table 1 and illustrated in Fig. 1.

Walking quintiles were categorised as follows:

- group 1: unable to walk ( $n = 171$ );
- group 2: 0.00–0.21 m/s ( $n = 142$ );
- group 3 0.22–0.33 m/s ( $n = 141$ );

**Table 1**  
Patient characteristics.

Frailty score	1–2	3	4	5	6	7–8
Count (%)	23 (2.6)	74 (8.4)	103 (11.7)	163 (18.6)	330 (37.6)	185 (21.1)
Age	81.7 (5.69)	83.7 (5.82)	84.5 (6.06)	86.7 (5.60)	87.3 (5.99)	86.15 (6.10)
Female	11 (47.8)	41 (55.4)	45 (43.7)	101 (62)	195 (59.1)	120 (64.9)
ED-MEWS	3.0 (1.0–4.0)	2.0 (1.0–3.0)	3.0 (2.0–4.0)	2.0 (1.0–3.0)	3.5 (2.0–3.0)	2.0 (2.0–4.0)
AMT4	4.0 (4.0–4.0)	4.0 (4.0–4.0)	4.0 (4.0–4.0)	4.0 (3.0–4.0)	4.0 (2.0–4.0)	2.0 (0.0–4.0)
Length of Stay (days)	2.2 (1.9–8.0)	3.7 (2.0–7.0)	6.6 (3.2–12.8)	8.8 (4.6–14.9)	8.8 (4.4–19.1)	8.7 (4.6–21.9)
Able to walk 6 m on discharge	21 (95.5)	62 (98.4)	83 (90.2)	123 (89.8)	214 (78.4)	67 (45.9)
6MWT walking speed	0.61 (0.42–0.79)	0.45 (0.29–0.67)	0.43 (0.27–0.60)	0.32 (0.24–0.46)	0.28 (0.17–0.40)	0.25 (0.17–0.44)
Walking Quintile	5.0 (4.0–5.0)	4.0 (3.0–5.0)	4.0 (3.0–5.0)	3.0 (2.0–4.0)	2.5 (2.0–4.0)	1.0 (1.0–3.0)

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