Association Between Clinical Frailty Scale Score and Length of Stay in a Complex Discharge Unit

A. McDermott, G. Kerr, J. Browne

St. James's Hospital, James's Street, Dublin 8, Ireland.

Abstract

Introduction
Older frail individuals are at risk of prolonged hospital stays which can lead to negative health outcomes. Evidence suggests that frailty, measured with the clinical frailty scale (CFS), is associated with longer acute hospital stay. Recently, St. James's Hospital Dublin, opened a sub-acute complex discharge unit (CDU) which aims to reduce length of hospital stay in older individuals by providing optimal inter-disciplinary team discharge planning. The aim of this study was to investigate if frailty was associated with length stay in the CDU.

Methods
Grip strength timed up and go (TUAG) and CFS rating were recorded for 104 participants admitted to the CDU over a 6-month period. Reason for hospital admission, length of stay (LOS) and discharge destination were also recorded.

Results
There was a significant positive correlation between TUAG and LOS ($r = 0.22$ $p < 0.04$) and CFS and LOS ($r = 0.29$, $p < 0.004$) while regression analysis of the data revealed that only CFS was a significant predictor of LOS ($r = 0.44$, $p < 0.05$).

Discussion
Higher CFS score is associated with longer LOS in the CDU. Therefore, the CFS may be a simple tool for identifying patients at risk of prolonged length of stay.

Introduction

People over the age of 65 represent approximately 13% of the population of Ireland and it is predicted that the number of people living in Ireland over the age of 65 will increase by 59% by 2031 [1]. In addition, this population accounts for approximately 45% of acute hospital admissions in Ireland [1]. Recent evidence has shown that in older individuals, prolonged length of hospital stay is associated with an increased risk of infection and mortality during hospital admission and is associated with deconditioning, cognitive impairment, decreased functional independence and reduced mobility[2-4]. Therefore, the ability to predict length of stay and to identify factors that may influence length of hospital stay is becoming increasingly important. It has relevance to both the individual patient in terms of planning care and enhancing quality of life and to the acute hospital setting in terms of providing, resourcing and developing an effective and safe service[5].

Among older individuals, the frail person is at particular risk of hospitalisation and is predisposed to adverse events and complications during hospitalisation. Frailty has been defined as a significant decline in physiological reserve capacity across several of the body's organ systems resulting in an increased vulnerability to stressors [6]. Attempts have been made to objectively measure and stratify frailty in both clinical and research cohorts. For instance, the frailty index aims to provide a definition of frailty through counting various clinical deficits while other clinical research groups have suggested using a specific phenotype with which to define the frail individual[7]. While both options have their merits and assess for the reduction in physiological reserve associated with frailty, neither of these tools account for the stressor that the frail individual may become vulnerable to. On the other hand, the clinical frailty scale stratifies the individual into a level of vulnerability based on a comprehensive assessment and the use of simple clinical descriptors[8]. In addition, the CFS has been shown to predict length of stay and discharge destination in older individuals admitted to the acute medical setting[9,10].

Recently, St James's Hospital Dublin, developed the 23-bed complex discharge unit (CDU) which aims to reduce the length of hospital stay of frail and older individuals, by providing optimal discharge planning, through inter-disciplinary team input. Individuals admitted to the CDU are transferred from the acute setting when their acute medical needs have resolved, and they are requiring additional therapy or intense discharge planning. The medical governance of patients is overseen by a medical registrar and a supervising consultant physician. The MDT present on the CDU comprises of a full-time physiotherapist and social work and part-time occupational therapist, speech and language therapist and clinical nutritionist. Admission criteria to the unit include but are not limited to, patients of any age, patients who are medically stable and nearing discharge but require further goal orientated input from the MDT, patients who have a Home Care Package approval pending and/or are awaiting funding/a service provider.

It is of interest to examine whether factors such as physical function and frailty adversely affect length of stay in this patient cohort. Therefore, the aims of this study were to establish a physical profile of patients admitted to the CDU and to examine whether frailty, assessed using the clinical frailty scale, was associated with length of stay in the CDU.

Methods

All patients admitted to the CDU over a 6-month period were invited to participate in the study. Patients who were not able to provide informed consent were excluded. Ethical approval for this study was granted by the St. James's Hospital/ Tallaght University Hospital research ethics committee.

Within 24 hours of admission to the CDU participants were assessed and the following measurements were completed: grip strength, timed up and go (TUAG) and clinical frailty scale (CFS) rating. In addition, the following information was recorded during the participant's admission to the CDU: Age, gender, reason for hospital admission, mobility status on admission to the CDU, discharge destination and length of hospital stay.

The timed up and go test is a simple mobility test that is commonly used in in-patient and out-patient settings to assess an individual's risk of falls [11]. Participants were asked to stand from a seated position in a standard ward chair with armrests, walk 3 metres at their usual walking pace to a marker in the floor turn around, walk back to the chair, and sit down again. Timing of the test began from the command "Go" and was stopped when the participant had returned to a seating position. Participants were permitted to use a mobility aid if required.

Grip strength was measured using a digital Smedley Spring handheld dynamometer (Fabrication Enterprises Inc, White Plains, NY, USA). Measurements were taken in the seated position with the arm being assessed supported by the armrest of the chair while the participant was instructed to keep their shoulder by their side and their elbow flexed at 90 degrees. The participant was asked to squeeze the dynamometer as hard as they could for 3 seconds and the maximal force produced was recorded. The test was repeated three times with a 10s rest between each squeeze and the mean of the three measurements was taken as the participant's grip strength. There is evidence to suggest that grip strength, as measured with a handheld dynamometer, is a good proxy for global body strength[12]. Furthermore, it has been shown that reduced grip strength is associated with an increased risk of mortality, cognitive decline and an increased risk of fractures [12, 13].

The Clinical Frailty Scale (CFS) was developed to provide clinicians with an easily applicable clinical tool to stratify elderly adults according to level of vulnerability. The CFS was validated in a sample of 2305 older individuals from the Canadian Study of Health and Aging and has been shown to be a strong predictor of institutionalization and mortality[8,14].

Statistical analysis was performed using SigmaPlot 12.0 (Systat Software, San Jose, CA). Normality of the data was assessed using the Shapiro-Wilk test. Correlations between independent variables were assessed using the non-parametric Spearman-rank correlation coefficient. A logarithmic transformation of LOS (log LOS) produced a normal distribution of the LOS data. The logLOS values were then used as the dependent variable in a multiple regression analysis using CFS, TUAG and grip strength scores as the independent variables. Statistical significance was set at $p < 0.05$. Data are displayed as mean (standard deviation (SD)) unless otherwise stated.

Results

Participant characteristics

One hundred and thirty-one patients were admitted to the CDU of which 104 consented to participate in the study. The main reasons for exclusion from the study included the inability to give informed consent and declining to participate. Participants' characteristics and physical measurements are displayed in Table 1. The mean age of participants was 79.9 ± 10.0 years and 64% of participants included in the study were female. Mean length of stay in the CDU was 22.3 ± 21.8 days but length of stay ranged from 1-116 days (median: 14 days). The majority of the admissions to hospital were due to falls (25%) with other reasons for admission including general decline, respiratory symptoms, cardiac problems and confusion/acute delirium (see Table 2). On admission to the CDU 35% of participants mobilised independently while 65% required some degree of supervision or assistance to mobilise safely. Forty percent of patients admitted to the unit were classed as non-frail or mildly frail whereas 47% were classed as moderately frail and 13% as severely frail.

Table 1. Participant Characteristics.

Age (years)	79.9 (10.0)
Gender (male/female)	37/67
Length of stay (days)	22.3 (21.8)
Timed up and go (s)	29.2 (20.9)
Grip Strength (kg)	15.0 (7.4)
Clinical Frailty Scale rating (a.u.)	4.8 (1.7)

Data are mean (SD). s, second; kg, kilogramme; a.u., arbitrary units

Table 2. Reason for hospital admission.

	n
Fall	26
Stroke/TIA	3
Respiratory symptoms (SOB, LRTI, Cough, wheeze, IECOPD)	16
Confusion/Acute Delirium	13
General Decline	4
Cellulitis/ lower limb ulcers	8
Cardiac Symptoms	8
Other (pain, anaemia, further investigations, day procedure, urosepsis, bowel obstruction, seizures, worsening neurological symptoms)	25

TIA, transient ischaemic attack; SOB, shortness of breath; LRTI, lower respiratory tract infection; IECOPD, infective exacerbation of chronic obstructive pulmonary disease. The above data is based on 103 participants as admission. Data for one participant was unavailable.

Discharge destination

Seventy-six participants were discharged directly home from the CDU with or without support from the community and 9 patients were discharged to a long-term care setting. Nine patients were discharged to convalescence/step down unit from the CDU. At the time of writing, 3 patients were still in-patients in the CDU, 3 patients had been transferred back to the acute hospital setting, 3 patients had not yet confirmed their discharge destination and 1 patient had passed away.

Correlations

There were significant positive correlations between TUAG and length of stay (r = 0.22 p <0.04) and CFS and length of stay (r = 0.29 p <0.004, Figure 1). There was a positive correlation between CFS rating and age (r = 0.34 p <0.001) and TUAG score (r = 0.69 p <0.001) and a negative correlation between CFS rating and grip strength (r = -0.27 p < 0.02). A multiple linear regression analysis, where logLOS was the dependent variable and grip strength, TUAG, CFS and age were the independent variables showed that CFS rating was the only significant predictor for logLOS (r = 0.44 p < 0.05). A subgroup analysis was performed on the data of patients who were discharged home from the CDU (n=76). There was a significant positive correlation between TUAG and length of stay (r = 0.31 p = 0.01) and CFS and length of stay (r = 0.36 p <0.002) observed in this subgroup.

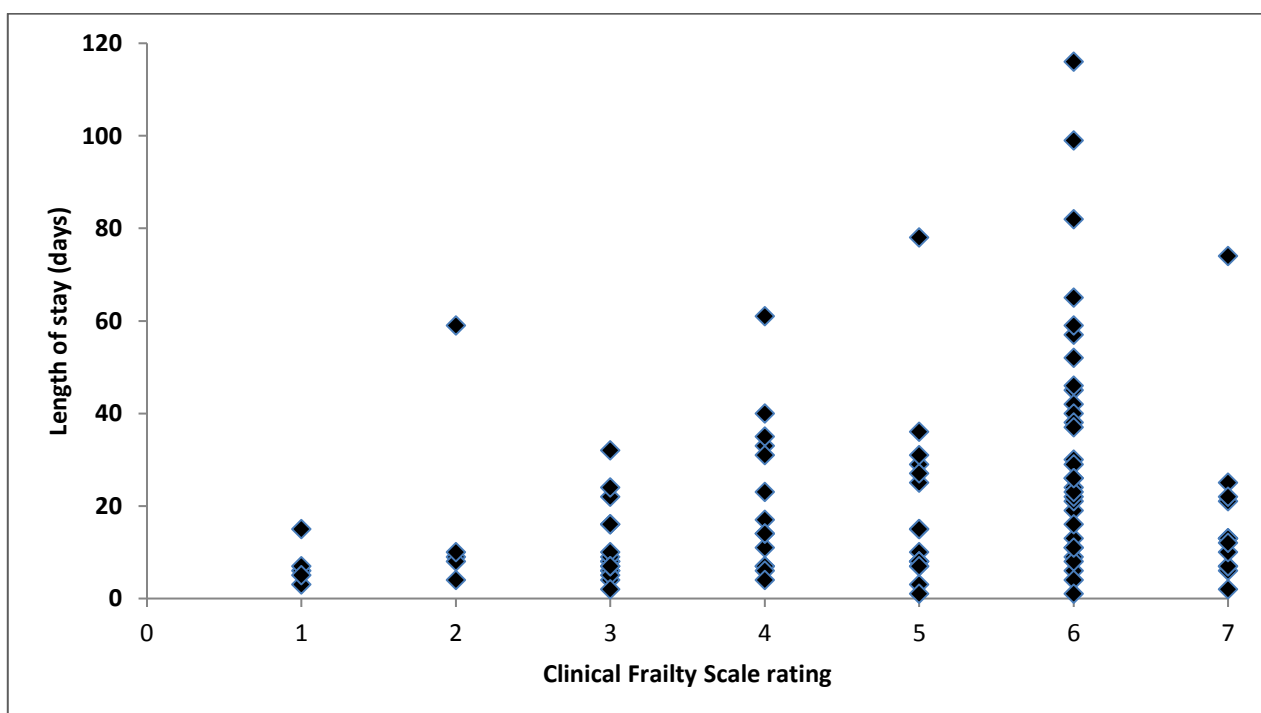**Figure 1.** Significant positive correlation between clinical frailty scale rating and sub-acute length of stay (r = 0.29 p < 0.004).

Discussion

The primary findings of the current study were that CFS rating is a predictor of length of stay in this patient sample while increased TUAG and CFS scores were significantly correlated with increased length of stay in the CDU.

Our results are in agreement with previous studies which have suggested that frailty can predict length of stay in several specific patient populations such as post-surgical[15], subacute medical[16] and patients with acute coronary syndrome[17]. However, it is important to note that these studies have used a variety of frailty scales including the CFS. Recently, a large study including more than 2,000 patients explored the predictive ability of the CFS in patients admitted to an older person's unit for acute medical issues such as delirium, deconditioning, and functional impairment[10]. Frailty was found to predict in-hospital mortality, length of stay and likelihood of discharge to long term nursing home care[10]. In a smaller cohort study CFS rating predicted length of stay in 75 older individuals admitted to an acute medical unit[9]. Furthermore, it was found that the mean length of stay was 8.5 days longer in the those classified as severely frail compared to those classified as non-frail while those classified as moderately frail had a length of stay that was on average 7.1 days longer than that of non-frail patients (Severely frail: 12.6 ± 12.7 days Moderately frail 11.2 ± 10.8 days vs non-frail 4.1 ± 2.1 days)[9]. A similar trend was identified in the current study as those who were non frail had a markedly lower length of stay compared to moderately-frail individuals (Severely frail: 17.3 ± 18.3 days vs Moderately frail 27.0 ± 25.9 days vs non-frail 14.6 ± 14.3 days). Interestingly, severely frail patients had a markedly shorter length of stay than moderately frail individuals. An explanation for this may be that more severely frail patients were admitted from nursing homes and were likely discharged back to their care homes therefore, their discharge planning was at a more advanced stage than the moderately frail patients who may have been awaiting a decision regarding discharge destination or funding for increased home supports. This difference in length of stay between different classifications of frailty is both clinically and economically significant given the increased risk of in hospital deconditioning and physical inactivity as well as the associated significant financial cost of extra days of hospital admission.

The pathway into the CDU is for those patients who require an additional period of MDT input and discharge planning but are medically fit for discharge. This pathway alleviates pressure on the medical beds by transferring patients who don't require significant medical input. Similarly, the CDU reduces the number of patients waiting for intensive rehabilitation beds by identifying those who need only a short period of input from the relevant MDT members. Ultimately, if the correct patients are transferred to the CDU there should be a subsequent improvement in patient flow through the acute hospital setting. Future studies completed on the CDU will aim to validate the pathway to the CDU by examining its impact on overall length of stay in the acute hospital stay. Furthermore, other service indicators such as readmission rate and early identification of potential patients for the CDU in the emergency department and acute medical assessment unit will be investigated.

 There are several limitations to the current study. Firstly, we had a relatively small sample size of patients which may reduce the power of the statistical tests used. Secondly, the researcher rating each individual on the CFS was not blinded from the individual's demographic characteristics, co-morbidities, medications or functional status. Thirdly, patients who were not able to give informed consent were excluded from the study which resulted in the exclusion of patients with moderate and severe cognitive impairment. This is a limitation as cognitive impairment is a key contributor to frailty.

In conclusion, CFS score was a predictor of LOS in this sample cohort. In addition, both CFS score and TUAG time were positively correlated with LOS in the CDU. Both the CFS and TUAG are simple, time efficient measures that require little equipment to administer. Therefore, both instruments are useful clinical tools that could potentially identify older individuals who may be more likely to experience a prolonged stay in the CDU.

Declaration of Conflicts of Interest:
The authors declare no conflict of interest.

Corresponding Author:
Dr Adam McDermott
Physiotherapy Department,
Hospital 4,
St. James's Hospital,
James's Street,
Dublin 8,
Ireland.
Email: mcdermad@tcd.ie

References:
1. Health Service Capacity Review Executive Report (2018). Review of healthcare demand and capacity requirements in Ireland to 2031 – Findings and recommendations. HSE, Government of Ireland
2. Lang PO, Heitz D, Hédelin G, Dramé M, Jovenin N, Ankri J,et al. Early markers of prolonged hospital stays in older people: a prospective, multicenter study of 908 inpatients in French acute hospitals. Journal of the American Geriatrics Society. 2006; 54:1031-9.
3. Bo M, Fonte G, Pivaro F, Bonetto M, Comi C, Giorgis V et al. Prevalence of and factors associated with prolonged length of stay in older hospitalized medical patients. Geriatrics & Gerontology International. 2016; 16:314-21.
4. Toh OH, Lim ZY, Yap P & Tang T. Factors associated with prolonged length of stay in older patients. Singapore Medical Journal. 2017; 58(3), 134-138.
5. Omachonu VK, Suthummanon S, Akcin M, Asfour S. Predicting length of stay for Medicare patients at a teaching hospital. Health Services Management Research. 2004; 17: 1–12.
6. Dent E, Martin FC, Bergmann H, Woo J, Romero-Ortuno R, Walston JD. Management of frailty: opportunities, challenges and future directions. Lancet. 2019; 394: 1376-1386
7. Fried L, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J et al. Frailty in older adults: evidence for a phenotype. The Journals of Gerontology Series A Biological Sciences and Medical Science.. 2001;56:M146–M157.

8. Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell et al. A global clinical measure of fitness and frailty in elderly people. Canadian Medical Association Journal. 2005;173(5):489–95.

9. Juma S, Taabazuing MM & Montero-Odasso (2016). Clinical Frailty Scale in an Acute Medical Unit: a Simple Tool that predicts Length of Stay. Candian Geriatrics Journal 2016; 19 (2), 34-39.

10. Basic D, Shanley C. Frailty in an older inpatient population: using the clinical frailty scale to predict patient outcomes. Journal of Aging and Health. 2015;27:670–85.

11. Podsiadlo D, Richardson S. The timed "up & go": a test of basic functional mobility for frail elderly persons. Journal of the American Geriatrics Society. 1991;39(2): 142–148.

12. Cooper R, Kuh D, Hardy R; Mortality Review Group; FALCon and HALCyon Study Teams. Objectively measured physical capability levels and mortality: systematic review and meta-analysis. British Medical Journal. 2010; 341:c4467.

13. Cooper R, Kuh D, Cooper C ,Gale CR, Lawlor DA, Matthews F et al. Objective measures of physical capability and subsequent health: a systematic review. Age & Ageing. 2011; 40: 14–23.

14. Islam A, Muir-Hunter S, Speechley M, Montero-Odasso M. Facilitating frailty identification: comparison of two methods among community-dwelling older adults. The Journal of Frailty & Aging. 2014;3(4):216–221.

15. Kim SW, Han HS, Jung HW, Kim KI, Hwang DW, Kang SB et al. Multidimensional frailty score for the prediction of postoperative mortality risk. Journal of the American Medical Association Surgery. 2014;149(7):633–40.

16. Haley MN, Wells YD, Holland AE. Relationship between frailty and discharge outcomes in subacute care. Australian Health Review. 2014; 38(1):25–29.

17. Graham MM, Galbraith PD, O'Neill D, Rolfson DB, Dando C, Norris CM. Frailty and outcome in elderly patients with acute coronary syndrome. Canadian Journal of Cardiology. 2013;29(12):1610