Article:
Eagleton, G., Güven, R., Thorsteinsdóttir, T. et al. (2 more authors) (2025) Concordance with routine Clinical Frailty Scale screening in the frailty in European emergency departments (FEED) study. International Emergency Nursing, 78. 101565. ISSN: 1755-599X

https://doi.org/10.1016/j.ienj.2024.101565

International Emergency Nursing 78 (2025) 101565

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

Original research

Concordance with routine Clinical Frailty Scale screening in the frailty in European emergency departments (FEED) study

Georgia Eagleton [a], Ramazan Güven [b], Thordis Thorsteinsdóttir [c], Evgeny Mirkes [d], James D. van Oppen [a,e,*], On behalf of the European Taskforce on Geriatric Emergency Medicine collaborators

[a] College of Life Sciences, University of Leicester, Leicester, UK
[b] Health Science University, Istanbul Cam and Sakura City Research and Training Hospital, Department of Emergency Medicine, Istanbul, Turkey
[c] Faculty of Nursing and Midwifery, University of Iceland, Reykjavík, Iceland
[d] School of Computing and Mathematic Sciences, University of Leicester, Leicester, UK
[e] Centre for Urgent and Emergency Care Research, University of Sheffield, Sheffield, UK

ARTICLE INFO

Keywords:
Emergency care
Frailty
Clinical Frailty Scale
Screening
Data

ABSTRACT

Background: Frailty screening determines who receive geriatric emergency medicine interventions that are of high importance for patient outcomes. However, post-implementation evaluations show around 50% older Emergency Department (ED) attenders to receive screening. Why and who are omitted from screening remains largely unstudied. This study gave opportunity to compare normal screening status to data from a targeted screening study.

Methods: The parent Frailty in European Emergency Departments (FEED) study administered the Clinical Frailty Scale (CFS) to consecutive ED attenders on 04 July 2023. This present study considered a subset of sites which provided retrievable CFS data from a "normal day" two weeks prior. Symmetry and dependency of missing CFS entries with observed variables were assessed. The frailty distribution was then compared with the parent FEED study data.

Results: A minority of sites (5/62) recorded CFS in retrievable format. 55 % "normal day" CFS entries were missing compared with 14 % consecutive attenders during the parent FEED study. While no pattern was evident in the FEED cohort, "normal day" CFS entries were more frequently missing with non-white ethnic group (76 %, vs 52 % with white group), self-presentation (68 %), and discharge home from ED (59 %). CFS distributions differed between the routine and research day datasets ($p = 0.009$).

Conclusion: Our findings suggest systematic, non-random omission of CFS in normal screening practice, disproportionately affecting people with non-white ethnic group and self-presentation. This raises concern for limitations when routine CFS data are analysed and prompts study and improvement of concordance with screening.

1. Introduction

The 2023 cross-sectional Frailty in European Emergency Departments (FEED) study recently showed that 43 % of older people presenting to emergency departments (EDs) were living with frailty [1]. Care of older people living with frailty in the ED is often complex due to comorbidity, polypharmacy, and functional decline. Despite this, current emergency care systems are typically not designed to deliver multidimensional care at scale [2,3]. European geriatric emergency medicine guidelines recommend early identification of frailty by screening in acute hospital settings [4]. There are a number of measures of frailty and there is currently no consensus on their administration. However, the Clinical Frailty Scale (CFS) is now being widely used and has been systematically implemented in some healthcare systems [5,6]. The CFS is a rapid assessment using clinician judgement to quantify the impacts of cumulative health deficits [7,8]. It has been selected for research and clinical applications for its ease of use and validity of correlation with mortality, admission rates, and length of stay [9,10,11].

* Corresponding author at: Centre for Urgent and Emergency Care Research, University of Sheffield, Sheffield S1 4DA, UK. Department of Population Health Sciences, University of Leicester, Leicester LE1 7HA, UK.
E-mail address: james.vanoppen@doctors.org.uk (J.D. van Oppen).

https://doi.org/10.1016/j.ienj.2024.101565
Received 4 April 2024; Received in revised form 20 November 2024; Accepted 3 December 2024
Available online 25 December 2024

Frailty screening aims to provide appropriate interventions, improve quality of care, and reduce length of stay by identifying people at risk to prompt a broader holistic healthcare approach. This is typically based on the comprehensive geriatric assessment (CGA): an interdisciplinary framework to evaluate and ameliorate the more complex healthcare needs of older people which can be initiated in emergency care and continued longitudinally [2,12]. For all those in need of this comprehensive care screening must be integrated into emergency care processes so that administration is equitable, and individuals are not neglected [13]. During the FEED study, a survey of participating sites found 69 % EDs to be using the CFS [14]. Despite its simplicity and even when mandated, daytime CFS screening completion has approximated only 50 % in European studies [15,16]. Programmes seeking to implement geriatric emergency care assessments have previously been found to be affected by professionals' time constraints and their prioritisation of competing tasks [17]. Frailty screening is no different, often being performed by emergency nurses with simultaneous requirements to carry out myriad clinical and functional assessments and procedures in limited time.

While the characteristics of those assessed for frailty have been well studied, these are not apparent for those not routinely included in screening. Therefore more is to be known whether frailty screening is being delivered in a fair and representative manner.

The FEED study determined frailty prevalence using a flash mob design, in which many collaborators recruit simultaneously to collect a large volume data in a short period of time [18]. FEED involved prospective collection of the CFS during all emergency care attendances by consecutive older people (aged 65 +) during a twenty-four-hour period and the study has been reported previously [1]. This was achieved for 91 % older people (n = 3435) attending sixty-two emergency departments in sixteen countries, and there was no evident pattern of missingness. In this current study, we now examine and compare this finding with the rate of missing data during frailty screening on a "normal day". We conduct an analysis of missingness within additional data from routine screening practice, with the objective of identifying patterns of certain characteristics being included or excluded. The goal of this current study was therefore to inform understanding and improvements in frailty screening practice and protocols.

2. Methods

2.1. Study design and research participants

This paper concerns a planned secondary objective of the FEED study. This sub-study used subsetted data from those sites participating in FEED which were routinely collecting the Clinical Frailty Scale and recording this in a retrievable electronic record. This was to enable comparison of the consecutive CFS administrations on the day of the FEED study with those CFS data collected on a previous "normal day".

2.2. Data collection

Collection of prospective observational data for all people aged 65 + who attended (registered at) the sixty-two participating departments during a twenty-four-hour period starting 04 July 2024 was as previously reported [1]. Data variables were those routinely collected as part of standard emergency care and included individuals' age, Clinical Frailty Scale version 2.0 [7], sex, ethnic group coded into UK Office for National Statistics categories [19], mode of arrival to the ED, initial vital signs and corresponding calculated National Early Warning Score (version 2; NEWS2), ED arrival and departure times, use of resuscitation areas, and ED disposition outcome.

Retrospective ("normal day") data for these same variables were also retrieved from those sites using electronic health records for a twenty-four-hour period two weeks prior on 20 June 2023, representing all individuals who attended that day. These retrospective data were analysed for this missingness evaluation.

2.3. Statistical analysis

Data were examined for normality using graphical and Shapiro-Wilk methods, and were processed and analysed using R with the packages *ggplot2*, *lubridate*, *patchwork*, and *tidyverse* [20]. The number of sites which recorded the CFS in a retrievable electronic format was presented as the proportion of all participating centres, representing the fraction where frailty data existed in a format suitable for extraction and analysis.

Our analysis considered the pattern of missingness within the retrospective ("normal day") data. Evaluation of missingness sought to determine whether there were systematic (biased) relationships between frailty being missing and other observed variables for demographic or clinical characteristics. Such a systematic 'Missing Not At Random' (MNAR) pattern would be as opposed to Missing Completely At Random (MCAR) or At 'Random' (MAR), where absence of entries is independent from the person or process about which data were collected.

The approach followed the method described by Coats & Mirkes [21]: First, we examined the data and calculated the proportion of missing entries in each variable. To understand the symmetry of distribution of patients with missing and known data, we tabulated present and missing CFS entries by each observed variable (for example, age, ethnic group, attendance mode). The association of missing CFS with other observed variables was then determined using Kruskal-Wallis (for non-parametric continuous data) or chi-squared tests (for categorical frequencies). Finally, the association of CFS being missing with other variables being missing was assessed using chi-squared tests.

To inform reflection on usual (routine) screening practice as compared to optimal frailty scoring during recruitment for a research project, the distributions of CFS in the prospective and retrospective ("normal day") data were compared visually and with the Kruskal-Wallis test.

2.4. Ethics and regulatory approval

All data were considered fully anonymised at the point of transfer. The study received ethical approval for data processing and analyses, and further approvals for participation were obtained where required by local and national policies and legislation.

3. Results

3.1. Routine CFS data sources

Of sixty-two sites in the FEED study, forty-seven routinely collected the CFS and five recorded this in retrievable electronic health records. Four of these departments were in the United Kingdom and one in The Netherlands. Ethnicity data were not available at the Dutch site, which was excluded from that element of analysis.

Cumulatively, 368 older people attended these eligible departments on the day of prospective data collection, and 399 on the retrospective

Table 1
Participating sites and overall frequency of missing CFS data.

Site ID	"FEED day" (prospective)		"Normal day" (retrospective)	
	Observations N = 368	Missing CFS, % Overall = 14 %	Observations N = 399	Missing CFS, % Overall = 55 %
A	93	26	108	59
B	161	4	135	58
C	62	10	69	86
D	18	0	46	0
E	34	44	41	49

"normal day". Within these sites 14 % CFS observations were missing on the prospective day, while 55 % were missing on the "normal day" (Table 1).

3.2. Analysis of missingness

399 retrospective ("normal day") observations were available for analysis. Examination of the symmetry of missing CFS data by participant characteristics raised suspicion of systematic missingness (Table 2). The CFS was more frequently missing among people with younger age, non-white ethnic group, arrival time at night, self-presentation, and who were discharged from the ED. CFS was less frequently missing among those referred to ED by primary care.

Table 2
Symmetry and dependency of "normal day" missing CFS data by participant characteristics.

	Symmetry of missing data		**Missing CFS dependency on characteristic**	**Missing CFS dependency on variable missingness**
	CFS missing, *n (%)*	CFS present, *n (%)*	*p value*	*p value*
Age			0.002	
Median age (IQR)	*75 (11)*	*81 (10)*		
Age missing	0	0		NA
Ethnic group			0.007	
White ethnicity	163 (52)	149 (48)		
Non-white ethnicity	26 (76)	8 (24)		
Ethnicity missing	12 (100)	0		0.005
Arrival time			0.166	
Arrived at day	173 (54)	150 (46)		
Arrived at night	48 (63)	28 (37)		
Time missing	0	0		NA
Mode of arrival			<0.001	
Self-presented	110 (68)	52 (32)		
Primary care referral	16 (34)	31 (66)		
Ambulance	91 (51)	86 (49)		
Mode missing	3 (75)	1 (25)		0.774
Initial NEWS2			0.879	
Initial NEWS2 < 5	106 (61)	69 (39)		
Initial NEWS2 >=5	18 (62)	11 (38)		
Missing NEWS2	139 (58)	102 (42)		0.034
Used resus room			0.543	
Resus room = No	122 (55)	100 (45)		
Resus room = Yes	20 (61)	13 (39)		
Resus room missing	79 (55)	65 (45)		0.957
ED disposition			0.129	
Discharged	130 (59)	89 (41)		
Admitted	90 (50)	89 (50)		
Died	1 (100)	0		
Outcome missing	0	0		NA

CFS: Clinical Frailty Scale, version 2; NEWS2: National Early Warning Score, version 2 (a composite calculated from vital signs).

Missingness of the CFS variable appeared to be influenced by people's age ($p = 0.002$), ethnic group ($p = 0.007$), and mode of presentation ($p < 0.001$) (Table 2, column 4). These findings supported the presence of systematic, non-random missingness of the CFS. Comparison of missing CFS data with missing variables showed interdependency with missing ethnic group ($p = 0.005$) and missing NEWS2 ($p = 0.034$) (Table 2, column 5).

The distributions of CFS on the prospective and retrospective days differed significantly ($p = 0.009$) (Fig. 1). On the retrospective "normal day", no individuals were assigned CFS scores 1 or 9 (very fit or terminally ill) and people with CFS scores 4 and 6 (very mild and moderate frailty) appeared to be over-represented.

4. Discussion

Three-quarters of sites recruiting to the FEED study routinely used the CFS, but strikingly few recorded this in a retrievable electronic format suitable for data research. The presented evaluation of missingness is therefore restricted to a small proportion of participants, and the observed patterns require further evaluation and confirmation. In particular, these findings were predominantly reached from UK data and may not reflect wider practice. Inferences made regarding the 55 % missing CFS data in usual practice are limited by the analysis of short-term, snapshot emergency care data. Notably, this study did not examine the nuances of particular health records software, for example automatically filling frailty scores from data entered during a previous attendance. Further conclusions on health services use by people with varying characteristics cannot be made from the available data.

The parent FEED study had captured the CFS for 91 % attenders with no pattern of missingness. In contrast, approximately half of older people were omitted from ED frailty screening on the "normal day", with the 55 % missing rate observed here being similar to other European studies [6,15,16]. Contributors to professionals not completing CFS screening patients include high workload, competing administrative tasks and critical illness, while establishing clear routines and communicating the relevance to emergency care can increase concordance [16].

Missing data have commonly been observed in studies of the Frailty Index in older people [22]. This study demonstrated missingness to be systematic, with differences in the characteristics of individuals receiving assessment. People with higher missing CFS were those with younger age, non-white ethnic group, self-presenting attendances, and ED attendances resulting in discharge. The CFS was more frequently missing when ethnic group and vital signs were also missing. Attention to CFS parameters in usual practice appeared erroneous, with levels 4 and 6 assigned excessively and levels 1 and 9 omitted.

How missingness is handled is of great importance, as simply excluding a high percentage of data would compromise the reliability of

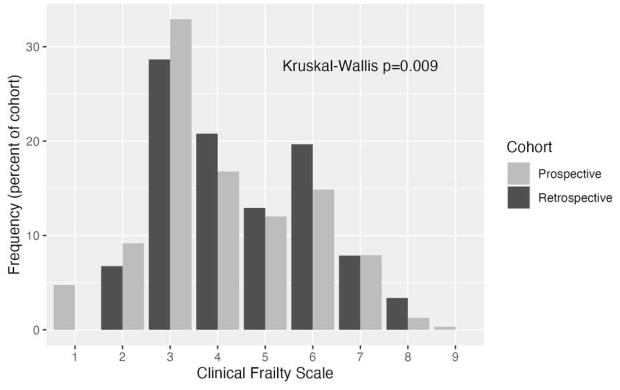

Fig. 1. Distributions of Clinical Frailty Scale in the prospective and retrospective data.

study results [23]. With evidence for systematic (not at random) missingness, replacing CFS data with multiple imputation would be inappropriate [24]. Therefore, to avoid severely limiting the findings and conclusions of future research with older people, attention to improving frailty screening concordance in routine data collection is warranted.

Disparate health outcomes are increasingly recognised in people with non-white ethnic groups, and indeed this study suggested systematic under-administration of CFS screening for non-white people. Further health services research to improve processes and outcomes is only possible with accurate reporting of data. The Dutch recruiting centre was legislatively prevented from collecting these data, and while only a small proportion of UK participants had missing ethnic group data, all of these had missing CFS. It is acknowledged that these individuals may have been too unwell to self-report or were streamed to other services at presentation precluding collection. Missing self-reported ethnicity in census datasets, which can be as high as 30 %, is more frequent in non-white ethnic groups [25,26]. Imputation methods have been evaluated, but perhaps a crucial first step is for open-mindedness among clinicians and researchers that systematic differences may exist in their systems.

Patients' mode of arrival at the emergency department also influenced CFS missingness, with screening more frequently omitted in those self-presenting than following ambulance or primary care contacts. People attending by ambulance typically have more frequent admission and more laboratory and radiologic tests orders than those who come independently [27]. They may also be more unwell or more dependent on support than those able to self-present. Referring source interventions can include the CFS and are conducted by professionals who may be more familiar with the person's living situation. The handover between referring sources and ED triage staff may prompt more comprehensive concordance with screening processes.

5. Conclusion

A minority of sites where CFS was routinely collected recorded this in a retrievable electronic format. Our findings reinforce the presence of systematic, non-random missing data in usual CFS screening. Factors increasing the likelihood of CFS data being missing included non-white ethnic group and self-presenting attendances. Systematic missingness in frailty data has critical implications for research in geriatric emergency medicine, warranting further study and improvement of screening practices.

5.1. European Taskforce on geriatric emergency medicine collaborators

Study protocol and management committee: Timothy Coats (UK), Simon Conroy (UK), Bas de Groot (Netherlands), Pieter Heeren (Belgium), Stephen Lim (UK), Jacinta Lucke (Netherlands), Simon Mooijaart (Netherlands), Christian H Nickel (Switzerland), Rose Penfold (UK), Katrin Singler (Germany), James D van Oppen (UK).

Participating site co-ordinators: Francesca Compton (UK), Sally Ko (UK), Jacinta Lucke (Netherlands), Stephen Thomas Gerard McKenzie (UK), Vittoria Sorice (UK), James D van Oppen (UK).

Ethical review

All data were considered fully anonymised at the point of transfer. The study received ethical approval for data processing and the described analyses (University of Leicester ref 39346), and further approvals for participation were obtained where required by local and national policies and legislation.

CRediT authorship contribution statement

Georgia Eagleton: Writing – review & editing, Writing – original draft, Formal analysis. **Ramazan Güven:** Writing – review & editing, Writing – original draft, Formal analysis. **Thordis Thorsteinsdóttir:** Writing – review & editing, Writing – original draft, Formal analysis. **Evgeny Mirkes:** Writing – review & editing, Writing – original draft, Methodology. **James D. van Oppen:** Writing – review & editing, Writing – original draft, Project administration, Formal analysis.

Funding

The FEED study received funding from the Royal College of Emergency Medicine.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: James van Oppen has received salary funding from the National Institute for Health and Care Research (Doctoral Research Fellowship 300901 and Clinical Lectureship), has received honoraria from the American Geriatrics Society, and is a co-chair of the geriatrics section of the European Society of Emergency Medicine. Remaining authors declare that they have no conflicts of interest. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR, NHS or the UK Department of Health and Social Care.

References

[1] European Taskforce on Geriatric Emergency Medicine collaborators. Prevalence of frailty in European emergency departments (feed): an international flash mob study. Eur Geriatr Med 2024. https://doi.org/10.1007/s41999-023-00926-3.
[2] Preston L, van Oppen JD, Conroy SP, et al. Improving outcomes for older people in the emergency department: a review of reviews. Emerg Med J 2021;38(12):882–8. https://doi.org/10.1136/emermed-2020-209514.
[3] Heeren P, Hendrikx A, Ceyssens J, et al. Structure and processes of emergency observation units with a geriatric focus: a scoping review. BMC Geriatr 2021;21(1):95. https://doi.org/10.1186/s12877-021-02029-9.
[4] Lucke JA, Mooijaart SP, Heeren P, et al. Providing care for older adults in the emergency department: expert clinical recommendations from the european task force on geriatric emergency medicine. Eur Geriatr Med 2022;13(2):309–17. https://doi.org/10.1007/s41999-021-00578-1.
[5] NHS Getting It Right First Time. Six steps to better care for older people in acute hospitals; 2023.
[6] Munir Ehrlington S, Horlin E, Toll John R, et al. Frailty is associated with 30-day mortality: a multicentre study of Swedish emergency departments. Emerg Med J 2024;41(9):514–9. https://doi.org/10.1136/emermed-2023-213444.
[7] Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173(5):489–95. https://doi.org/10.1503/cmaj.050051.
[8] Rockwood K, Theou O. Using the clinical frailty scale in allocating scarce health care resources. Canadian Geriatrics Journal : CGJ 2020;23(3):210–5. https://doi.org/10.5770/cgj.23.463.
[9] Fehlmann CA, Nickel CH, Cino E, et al. Frailty assessment in emergency medicine using the clinical frailty scale: a scoping review. Intern Emerg Med 2022;17(8):2407–18. https://doi.org/10.1007/s11739-022-03042-5.
[10] Albrecht R, Espejo T, Riedel HB, et al. Clinical frailty scale at presentation to the emergency department: interrater reliability and use of algorithm-assisted assessment. Eur Geriatr Med 2023. https://doi.org/10.1007/s41999-023-00890-y.
[11] Elliott A, Taub N, Banerjee J, et al. Does the clinical frailty scale at triage predict outcomes from emergency care for older people? Ann Emerg Med 2021;77(6):620–7. https://doi.org/10.1016/j.annemergmed.2020.09.006.
[12] Parker SG, McCue P, Phelps K, et al. What is comprehensive geriatric assessment (cga)? An umbrella review. Age Ageing 2018;47(1):149–55. https://doi.org/10.1093/ageing/afx166.
[13] Dobrow MJ, Hagens V, Chafe R, et al. Consolidated principles for screening based on a systematic review and consensus process. CMAJ 2018;190(14):E422–9. https://doi.org/10.1503/cmaj.171154.
[14] Fehlmann CA, Mc Loughlin K, Cosgriff EJ, et al. Service provision for frailty in european emergency departments (feed): a survey of operational characteristics. Scand J Trauma Resusc Emerg Med 2024;32(1):64. https://doi.org/10.1186/s13049-024-01234-w.
[15] Knight T, Atkin C, Martin FC, et al. Frailty assessment and acute frailty service provision in the UK: results of a national 'day of care' survey. BMC Geriatr 2022;22(1):19. https://doi.org/10.1186/s12877-021-02679-9.
[16] Horlin E, Munir Ehrlington S, Toll John R, et al. Is the clinical frailty scale feasible to use in an emergency department setting? A mixed methods study. BMC Emerg Med 2023;23(1):124. https://doi.org/10.1186/s12873-023-00894-8.
[17] Southerland LT, Stephens JA, Carpenter CR, et al. Study protocol for image: Implementing multidisciplinary assessments for geriatric patients in an emergency department observation unit, a hybrid effectiveness/implementation study using

the consolidated framework for implementation research. Implementation Sci Commun 2020;1:28.
[18] Moons P. Flash mob studies: a novel method to accelerate the research process. Eur J Cardiovasc Nurs 2021;20(2):175–8. https://doi.org/10.1093/eurjcn/zvaa020.
[19] Office for National Statistics. Ethnic group, national identity and religion 2021 [Available from: https://www.ons.gov.uk/methodology/classificationsandstandards/measuringequality/ethnicgroupnationalidentityandreligion.
[20] R Core Team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2022.
[21] Coats TJ, Mirkes EM. Missing data in emergency care: a pitfall in the interpretation of analysis and research based on electronic patient records. Emerg Med J 2024;41(9):563–6. https://doi.org/10.1136/emermed-2024-214097.
[22] Pridham G, Rockwood K, Rutenberg A. Strategies for handling missing data that improve frailty index estimation and predictive power: lessons from the nhanes dataset. Geroscience 2022;44(2):897–923. https://doi.org/10.1007/s11357-021-00489-w.
[23] Sterne JA, White IR, Carlin JB, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. BMJ 2009;338:b2393. https://doi.org/10.1136/bmj.b2393.
[24] Jakobsen JC, Gluud C, Wetterslev J, et al. When and how should multiple imputation be used for handling missing data in randomised clinical trials - a practical guide with flowcharts. BMC Med Res Methodol 2017;17(1):162. https://doi.org/10.1186/s12874-017-0442-1.
[25] Branham DK, Finegold K, Chen L et al. Trends in missing race and ethnicity information after imputation in healthcare.Gov marketplace enrollment data, 2015-2021. JAMA Netw Open. 2022;5(6):e2216715. Doi: 10.1001/jamanetworkopen.2022.16715.
[26] Dembosky JW, Haviland AM, Haas A, et al. Indirect estimation of race/ethnicity for survey respondents who do not report race/ethnicity. Med Care 2019;57(5):e28–33. https://doi.org/10.1097/MLR.0000000000001011.
[27] Umgelter A, Faust M, Wenske S et al. Do patients referred to emergency departments after being assessed in primary care differ from other ed patients? Retrospective analysis of a random sample from two german metropolitan eds. Int J Emerg Med. 2023;16(1):64. Doi: 10.1186/s12245-023-00542-9.