

RESEARCH ARTICLE

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A scoping review of the Clinical Frailty Scale

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Abstract

Background: Frailty is increasingly recognized as an important construct which has health implications for older adults. The Clinical Frailty Scale (CFS) is a judgement-based frailty tool that evaluates specific domains including comorbidity, function, and cognition to generate a frailty score ranging from 1 (very fit) to 9 (terminally ill). The aim of this scoping review is to identify and document the nature and extent of research evidence related to the CFS.

Methods: We performed a comprehensive literature search to identify original studies that used the Clinical Frailty Scale. Medline OVID, Scopus, Web of Science, CINAHL, PsycINFO, Cochrane Library and Embase were searched from January 2005 to March 2017. Articles were screened by two independent reviewers. Data extracted included publication date, setting, demographics, purpose of CFS assessment, and outcomes associated with CFS score.

Results: Our search yielded 1688 articles of which 183 studies were included. Overall, 62% of studies were conducted after 2015 and 63% of the studies measured the CFS in hospitalized patients. The association of the CFS with an outcome was examined 526 times; CFS was predictive in 74% of the cases. Mortality was the most common outcome examined with CFS being predictive 87% of the time. CFS was associated with comorbidity 73% of the time, complications 100%, length of stay 75%, falls 71%, cognition 94%, and function 91%. The CFS was associated with other frailty scores 94% of the time.

Conclusions: This scoping review revealed that the CFS has been widely used in multiple settings. The association of CFS score with clinical outcomes highlights its utility in the care of the aging population.

Keywords: Frailty, Aging, Frail elderly, Scoping review, Clinical Frailty Scale

Background

Worldwide, the population of older adults is expected to grow from 8.5% of people aged 65 and older to nearly 25% by 2050 [1]. As the population ages, the concept of frailty becomes increasingly relevant in the provision of health care to the population. Frailty was introduced nearly three decades ago to the geriatric medicine literature as a method of understanding and discerning the complex health status of older adults. Frailty is defined as a state in which there is an increase in an individual's

vulnerability for developing increased dependency and/or mortality when exposed to a physiological or psychological stressor [2]. Frailty can also be thought of as tipping the balance between reserve and insults, or positive and negative influences, leading to increased vulnerability [3]. People living with frailty are more vulnerable to the effects of potential stressors, and to deterioration than others of the same chronological age.

Frail individuals experience higher rates of adverse outcomes [4]. As such, assessing frailty early in the course of care is essential in order to identify those patients who are most vulnerable. Frailty measurement is integral for guiding patient care, as it helps clinicians determine which interventions will be more likely to be beneficial and which may be more harmful to particular individuals [5], for

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example more aggressive medical treatments. It has been suggested that all individuals over the age of 70 be screened for frailty [6]. Despite agreement on it being a multiply determined state of increased risk, consensus on a frailty definition has yet to be reached.

The Clinical Frailty Scale is a clinical judgement-based frailty tool developed for the Canadian Study of Health and Aging [7]. There it summarized the results of a Comprehensive Geriatric Assessment facilitating discussion of the impact of frailty when assessments had been conducted by physicians and nurses from a range of disciplines. The CFS evaluates specific domains including comorbidity, function, and cognition to generate a frailty score ranging from 1 (very fit) to 9 (terminally ill). Various reviews have been published on frailty suggesting the CFS is a promising frailty screening tool [8–10], however none of these have focused specifically on the CFS. Although the CFS is used commonly in both research and clinical care, there is currently no synthesis of its use. The objective of this scoping review was to map and synthesize the literature around the use of the CFS. This included identifying and documenting the nature and extent of research evidence pertaining to the CFS, with the aim of providing a more comprehensive description of its use across settings. We also examined the ability of the CFS to predict adverse

health outcomes. This knowledge could inform and support clinicians and policy makers in making decisions about resource allocation and service access.

Methods

Search strategy

The search strategy for this scoping review was developed with assistance from a librarian, with the aim of identifying all original studies that assessed the Clinical Frailty Scale (Appendix 1). A variety of databases including Medline OVID, SCOPUS, Web of Science, CINAHL, PsycINFO, Cochrane Library and Embase were searched from 2005 when the original CFS paper was published to March 2017. All relevant articles retrieved from this search strategy were included for screening. Additional studies were identified by manually searching the reference lists of potentially relevant papers and other frailty systematic reviews. SCOPUS and Web of Science searches were also completed for all articles citing the article which described the development of the CFS tool [7]. All articles identified were imported into *Covidence* software for screening.

Inclusion/exclusion criteria

Studies were only included when 1) they were original research and 2) the CFS was used. Due to the broad nature of this scoping review, we did not limit by language,

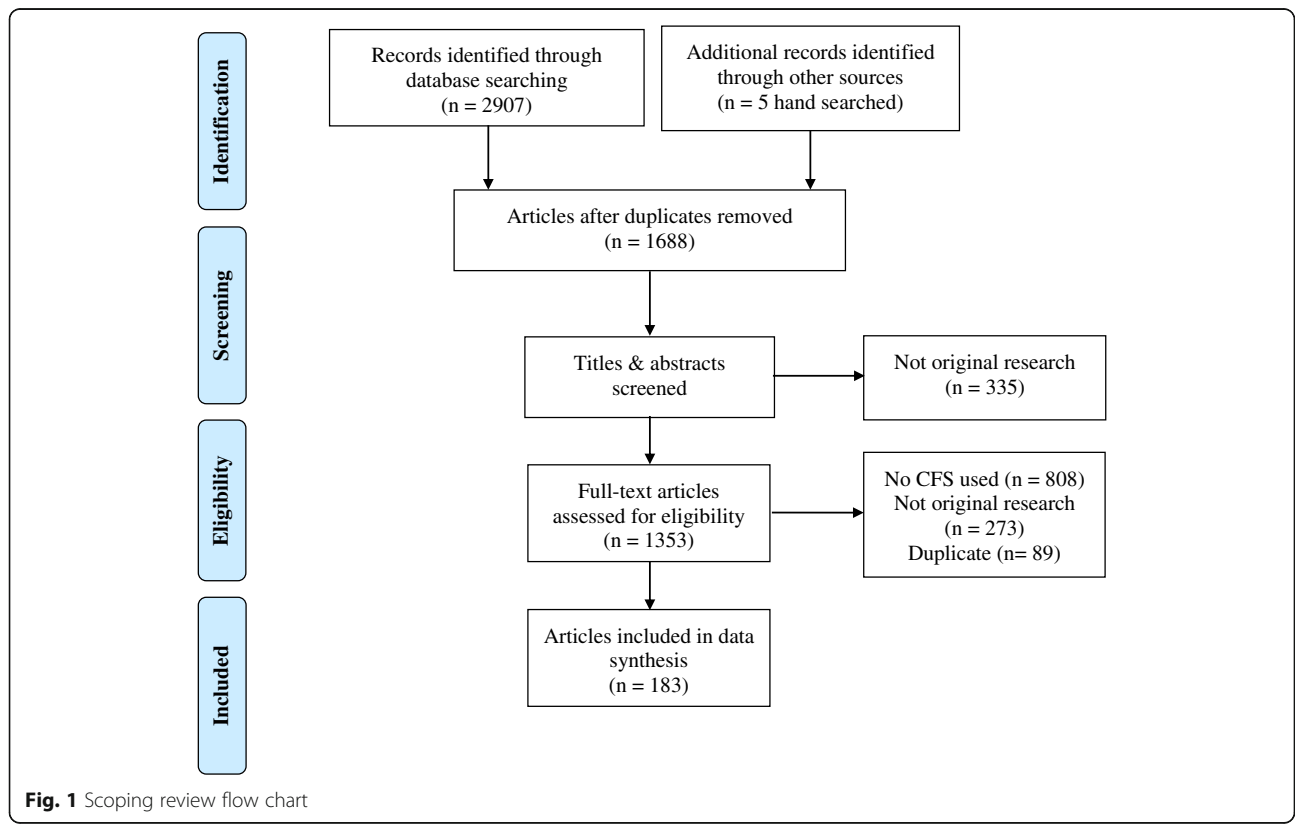


Fig. 1 Scoping review flow chart

study design, setting, age of participants or outcome measure. For non-English articles, members of the research team or colleagues with knowledge of the given language screened them and assisted in data extraction. Quality assessment is not a priority in scoping reviews; thus, studies were not excluded based on their quality.

Title and abstract screening

Title and abstract screening was completed in *Covidence* software. The only inclusion criterion for the title and abstract screening was whether the article described an original study. Review articles, conference abstracts, editorials and commentaries were excluded from the review. Screening was completed by two independent reviewers and conflicts were managed and resolved by discussion between the two reviewers, including a third reviewer when necessary.

Full text screening

Full text screening was also completed in *Covidence* software. Studies that include the Clinical Frailty Scale in their methods were included for data extraction; protocol papers proposing the use of the CFS in a study were also included. Studies that reference the CFS but did not

assess or plan to assess frailty with the CFS in a group of participants were excluded. Full text screening was completed by two independent reviewers, with conflicts managed by discussion to achieve consensus or by a third reviewer when necessary.

Data extraction and analysis

A data extraction form on Microsoft Excel was used to guide the collection of information from each article. Data was first extracted from 10 articles, and then this form was modified before the completion of the data extraction. The following descriptive data was extracted from each article that satisfied the inclusion criteria: year of publication, language, country, study design, and study setting. For completed studies (not protocol studies) participant demographics were extracted, including number of participants, and participant age and sex. With respect to the CFS, we extracted information about persons who administered the CFS, cut points for identification of frailty, frailty prevalence, and the purpose of the CFS assessment. All outcomes and variables that studies assessed for a relationship with CFS were recorded. As numerous outcome variables were identified, outcomes were grouped according to overarching

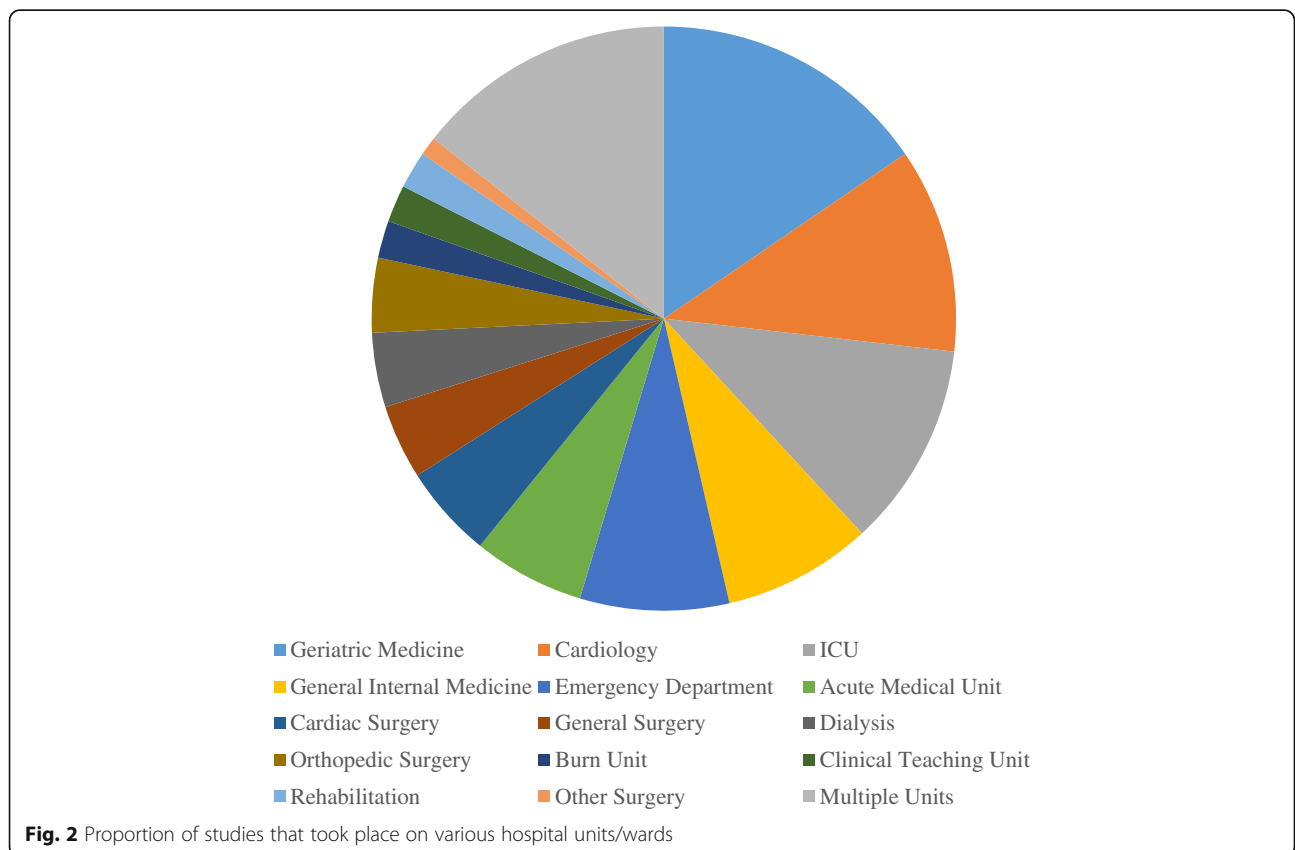


Table 1 Study characteristics stratified by study setting

	All	Hospital	Long-term Care	Outpatient Clinic	Community	Hospital and Community
Articles n (%)	183 (100)	115 (63.2)	10 (5.5)	13 (7.1)	32 (17.6)	12 (6.6)
Year n (%)						
2015+	114 (62.2)	80 (69.6)	4 (40.0)	10 (76.9)	11 (34.4)	9 (75.0)
2010–2014	63 (34.4)	34 (29.6)	5 (50.0)	3 (23.1)	19 (59.4)	2 (16.7)
2005–2009	6 (3.3)	1 (0.9)	1 (10.0)	0	2 (6.3)	1 (8.3)
Language n (%)						
English	168 (91.8)	103 (89.6)	9 (90.0)	13 (100)	31 (96.9)	11 (91.7)
German	5 (2.7)	5 (4.3)	0	0	0	0
Spanish	2 (1.1)	1 (0.9)	0	0	0	0
Japanese	3 (1.6)	2 (1.7)	0	0	0	1 (8.3)
Italian	2 (1.1)	2 (1.7)	0	0	0	0
Polish	2 (1.1)	1 (0.9)	0	0	1 (3.1)	0
Cantonese	1 (0.5)	1 (0.9)	0	0	0	0
Country n (%)						
Canada	53 (28.9)	32 (27.8)	3 (30.0)	4 (30.8)	8 (25.0)	6 (50.0)
UK	39 (21.3)	30 (26.1)	2 (20.0)	2 (15.4)	2 (6.3)	3 (25.0)
USA	6 (3.3)	4 (3.5)	0	0	1 (3.1)	0
Australia	10 (5.5)	8 (7.0)	0	0	2 (6.3)	0
Germany	10 (5.5)	7 (6.1)	0	2 (15.4)	1 (3.1)	0
Italy	6 (3.3)	5 (4.3)	0	1 (7.7)	0	0
Ireland	9 (4.9)	3 (2.6)	0	0	6 (18.8)	0
Taiwan	8 (4.4)	3 (2.6)	0	0	5 (15.6)	0
Japan	8 (4.4)	3 (2.6)	2 (20.0)	1 (7.7)	1 (3.1)	1 (8.3)
Poland	6 (3.3)	4 (3.5)	1 (10.0)	0	1 (3.1)	0
Netherlands	4 (2.2)	2 (1.7)	0	1 (7.7)	1 (3.1)	0
China	3 (1.6)	1 (0.9)	1 (10.0)	0	1 (3.1)	0
Colombia	2 (1.1)	2 (1.7)	0	0	0	0
Spain	2 (1.1)	1 (0.9)	1 (10.0)	0	0	0
Singapore	2 (1.1)	1 (0.9)	0	0	1 (3.1)	0
Other ^a	7 (3.5)	4 (3.6)	0	1 (7.7)	1 (3.1)	1 (8.3)
Multiple countries	3 (1.6)	1 (0.9)	0	1 (7.7)	0	1 (8.3)
Number of participants						
# of articles reporting	177	110	9	13	32	12
Range	1–27,527	1–12,282	15–728	32–3500	1–27,527	7–2305
Median (IQR)	261.0 (100.0–548.5)	305.0 (101.0–530.0)	160.0 (93.0–279.0)	124.0 (86.0–1023.5)	261.5 (95.3–803.0)	164.0 (44.0–525.0)
Mean age of participants						
# of articles reporting	135	84	7	9	24	11
Range	54.0–93.0	55.6–93.0	82.0–90.9	72.0–85.4	56.68–87.2	54.0–84.4
Median (IQR)	79.0 (71.4–82.9)	79.8 (70.8–82.9)	85.5 (82.9–88.0)	81.3 (75.4–83.0)	76.0 (70.9–79.5)	79.0 (62.0–84.2)
Percentage of females						
# of articles reporting	150	91	8	12	27	12
Range	0.0–100.0	0.0–90.7	64.0–88.8	23.5–77.8	32.0–100.0	29.0–100.0
Median	54.5	50.6	77.5	55.9	58.6	59.6

Table 1 Study characteristics stratified by study setting (*Continued*)

	All	Hospital	Long-term Care	Outpatient Clinic	Community	Hospital and Community
(IQR)	(44.0–64.0)	(41.8–57.0)	(74.0–79.6)	(37.8–74.1)	(52.5–64.0)	(50.3–68.8)
Study design n (%)						
Observational	156 (85.2)	101 (64.7)	10 (6.4)	11 (7.1)	25 (16.0)	9 (5.8)
Experimental	25 (13.7)	12 (48.0)	2 (8.0)	2 (8.0)	6 (24.0)	3 (12.0)
Qualitative	2 (1.1)	1 (50.0)	0	0	1 (50.0)	0

Note that as one article did not specify setting, it is only included in the “All” column

^aOther countries included New Zealand, Finland, Sweden, Brazil, Austria, France and Lithuania

number; IQR interquartile range

themes for the purpose of analysis. Analyses were conducted using IBM SPSS 21.

Results

Our database search retrieved 2907 articles and hand-searching identified 5 additional articles for a total of 2912. After duplicates were removed, 1688 articles were included for title and abstract screening. We screened the full text of 1353 articles and 183 articles (Appendix 2) were identified for data extraction (Fig. 1). The CFS was measured in hospitalized patients in 63% of the articles and in the community in 18% of the articles. Of the 97 in-hospital studies that reported the unit or ward, the most common units were Geriatric Medicine (15%) and Cardiology (11%) (Fig. 2). Of the 183 included studies, 168 were written in English (92%), most studies were conducted in Canada (29%) and in the United Kingdom (21%), and 62% of studies were conducted after 2015 (Table 1). In relation to study design, 85% of studies were observational and 14% were experimental; of these 25 experimental studies, 18 were randomized controlled trials (Table 1).

The CFS was assessed by researchers (46% of articles) and by a variety of professionals with physicians being the most common (24%). The CFS was originally developed as a 7-point scale but there is currently an updated 9-point version. Among the included articles, 58% used the 7-point scale and 38% used the 9-point scale (Table 2) with the 9-point version being the most common among the most recent studies (Supplementary Figure 1). When categorized, a CFS score of five was the most widely used frailty cut point (68.9%). Most studies (46.4%) used the CFS for risk stratification (i.e. to predict outcomes) (Table 2, Supplementary Figure 2). Of the 31 times the association between CFS score and age was examined, 77% found a significant relationship. Female sex was correlated with CFS score in 50% of the 18 times this association was tested (Supplementary Table 1).

The association of the CFS with outcomes was examined 526 times and was a significant predictor in 390 (74%) (Fig. 3). Several outcomes were examined, including mortality, comorbidity, disability, length of hospitalization,

re-admission, institutionalization, cognitive function and falls. Mortality was the most common outcome measure, evaluated 68 times. The CFS was significantly associated with mortality in 87% of the cases. Of the 62 instances that looked at the association of CFS with comorbidity, 73% found a significant positive correlation. The CFS score was predictive of function (current function or functional decline) in 91% of the 45 times function was evaluated. The association of the CFS with the type of treatment received by patients was examined 37 times and the CFS was significantly associated in 73% of the cases. CFS score was significantly associated with mobility in 90% of the 31 instances. In addition, of the 18 studies that looked at the correlation between CFS scores and other measures of frailty 94% found significant association (Fig. 3). A number of other outcomes and variables were examined for association with the Clinical Frailty Scale in smaller numbers of studies, and these are outlined in Supplementary Table 2.

Discussion

In this scoping review, we have reviewed the research evidence pertaining to the CFS. The CFS has been used in a variety of contexts around the world. Although most administered in Canada and the United Kingdom use of this tool has reached Asia, South America, and other parts of Europe. The number of publications measuring the CFS has increased in recent years, possibly reflecting the medical community’s interest in the topic of frailty as an important construct. The CFS is most often used in hospital settings, particularly on Geriatric Medicine and Cardiology units, however, has been applied to a range of inpatient and outpatient populations. The increase of its use in a variety of settings shows that researchers and clinicians value the ease and efficiency of using this judgement-based tool. In research, the CFS is commonly used to predict health outcomes. The outcomes with which it most has been reported to be significantly associated are mortality, comorbidity, functional decline, mobility, and cognitive decline.

This study was scoping in nature, allowing us to capture a broad range of information about the use of the CFS in research. However, this study is limited by the

Table 2 Frailty characteristics stratified by setting

	All	Hospital	Long-term Care	Outpatient Clinic	Community	Hospital and Community
Articles n (%)	183 (100.0)	115 (63.2)	10 (5.5)	13 (7.1)	32 (17.6)	12 (6.6)
Site of CFS assessment n (%)						
# articles reporting	180	112	10	13	32	12
On site	137 (76.1)	85 (75.9)	8 (90.0)	10 (76.9)	24 (75.0)	9 (75.0)
Retrospectively	27 (15.0)	18 (16.1)	1 (10.0)	2 (15.4)	4 (12.5)	2 (16.7)
On-site & retrospective	13 (7.2)	9 (8.0)	1 (10.0)	1 (7.7)	1 (3.2)	1 (8.3)
Telephone	3 (1.7)	0	0	0	3 (9.4)	0
Times CFS assessed n (%)						
Once	173 (94.5)	110 (95.6)	10 (100.0)	11 (84.6)	29 (90.6)	12 (100.0)
Twice	8 (80.0)	3 (33.3)	0	2 (20.0)	3 (33.3)	0
Three times	1 (10.0)	1 (10.0)	0	0	0	0
Four times	1 (10.0)	1 (10.0)	0	0	0	0
Person administering CFS n (%)						
# articles reporting	111	69	3	7	24	8
Researchers	51 (45.9)	33 (47.8)	0	1 (14.3)	13 (54.1)	4 (50.0)
Physicians	27 (24.3)	17 (24.6)	1 (10.0)	1 (14.3)	5 (20.8)	3 (37.5)
Nurse/NP	11 (9.9)	8 (121.6)	0	0	3 (12.5)	0
Other staff ^a	4 (3.6)	1 (0.9)	1 (10.0)	0	1 (4.2)	1 (12.5)
Clinical staff not reported	4 (3.6)	1 (0.9)	1 (10.0)	2 (28.6)	0	0
Mixed	14 (12.6)	9 (13.0)	0	3 (42.9)	1 (4.2)	0
Version of CFS used n (%)						
# articles reporting	153	96	9	9	30	9
7-point	89 (58.2)	48 (50.0)	5 (55.6)	7 (77.8)	22 (73.3)	7 (77.8)
8-point	6 (3.9)	5 (5.2)	0	0	1 (3.3)	0
9-point	58 (37.9)	43 (44.8)	4 (44.4)	2 (22.2)	7 (23.3)	9 (22.2)
Frailty cut-point n (%)						
# articles reporting	58	42	1	4	9	2
3	1 (1.7)	1 (2.4)	0	0	0	0
4	15 (25.9)	10 (23.8)	0	3 (75.0)	2 (22.2)	0
5	40 (68.9)	29 (69.0)	1 (100.0)	1 (25.0)	7 (77.8)	2 (100.0)
6	2 (3.4)	2 (4.8)	0	0	0	0
Frailty prevalence %						
# articles reporting	66	44	2	4	12	4
Range	2.4–100.0	2.4–87.5	75.6–100.0	25.0–48.0	2.9–77.0	11.1–71.0
Median (IQR)	32.8 (21.3–51.1)	31.9 (21.3–47.7)	87.8 (N/A)	34.7 (25.6–46.5)	40.25 (16.8–54.3)	44.4 (16.5–67.3)
Reason frailty measured n (%)						
Risk stratification	85 (46.4)	61 (53.0)	6 (60.0)	5 (38.5)	8 (25.0)	4 (33.3)
Inclusion/exclusion	14 (7.7)	5 (4.3)	0	1 (7.7)	6 (18.8)	2 (16.7)
Comparison with other scales	7 (3.8)	3 (2.6)	0	1 (7.7)	3 (9.4)	0
Outcome measure	9 (4.9)	6 (5.2)	0	2 (15.4)	0	1 (8.3)
Clinical decision	3 (1.6)	3 (2.6)	0	0	0	0
Descriptive only	33 (18.0)	20 (17.4)	2 (20.0)	2 (15.3)	7 (21.9)	2 (16.7)
Risk stratification and comparison of scales	21 (11.5)	11 (9.6)	2 (20.0)	1 (7.7)	5 (15.6)	2 (16.7)
Other mixed uses	10 (5.5)	6 (5.2)	0	0	0	1 (8.3)

Note that as one article did not specify setting, it is only included in the "All" column

^aOther staff includes personnel such as paramedics, LTC staff, junior medical staff and program evaluators
number; IQR interquartile range

fact that it is not a meta-analysis and thus does not examine the quality of the evidence presented in each article. It was our aim to provide a high-level overview of this scale and its uses. In addition, the initial search was completed in 2017 and therefore does not incorporate articles published more recently.

In recent years, as interest in frailty as a medical construct has increased, so too has the number of publications measuring the CFS. Overall, these studies have assessed the CFS in a range of different populations, which as a whole are representative of the general population of older adults. Preliminary analysis of this data demonstrated that the CFS has been found to be associated with a variety of important patient characteristics and clinical outcomes. Since the CFS combines clinical judgment with objective measurement and can be easily conducted, it has been seen as one of the most promising and practical ways of screening frailty in routine assessment [11] and especially in acute care [12].

This further supports the use of the CFS as a tool in clinical practice, as it provides valuable information to guide patient care and health policy development. Synthesizing the evidence around CFS and gaining a better understanding of its feasibility and psychometric properties, could assist with the development of education materials for clinicians about how the CFS can better inform the care they provide and how it can help them discuss with patients and their families the risks and benefits of potential treatments. This will assist clinicians

to provide more informed and rational shared decision making. Most recently, beyond what had been imagined when designed, and not without controversy [13–16], the CFS has been suggested as a tool that can guide rationing of critical care resources if they become overwhelmed in the COVID-19 pandemic [17]. For this reason, we published a guide for using the Clinical Frailty Scale for people new to the scale [18].

The CFS is mostly used within geriatric medicine, cardiology, intensive care, general medicine, emergency medicine, surgery, and dialysis; information for other medical specialties is lacking. The CFS is also not commonly used to predict patient-oriented measures such as quality of life, which should be included in future observation studies using the CFS. Using the CFS to assess the degree of frailty in clinical settings extends beyond evaluating risk to mitigating frailty by understanding disease presentation, acute management, recovery time, and rehabilitation potential.

Further research into the potential of this tool is warranted and will likely reveal novel applications to improve medical care of older adults. For example, investigation is warranted into whether implementing CFS in routine practice will improve care. In certain NHS centers in the United Kingdom, the CFS is routinely used to screen all patients over the age of 75 who are admitted to hospital via the Emergency Department [10]. Data from these institutions will be highly valuable in the advancement of frailty research.

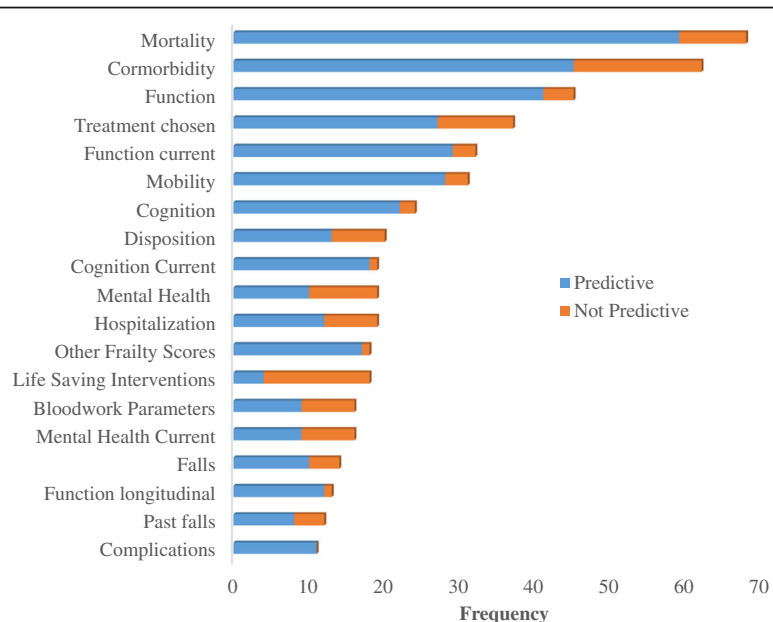


Fig. 3 Association of CFS with most frequent outcomes. *Note that variables such as “cognition” and “function” if not otherwise specified represent combined cross-sectional and longitudinal outcomes. “Current” indicates cross-sectional outcomes only and “Longitudinal” indicates longitudinal outcomes only

Conclusions

This scoping review revealed that the CFS has been widely used in multiple settings. Most of the included studies were conducted in hospital settings and most articles that examined the association of the CFS with adverse health outcomes showed that it has good predictive ability. The association of CFS score with clinical outcomes highlights its utility in the care of the aging population.

Appendix 1

SEARCH STRATEGY

((Clinical or “Canadian Study of Health and Aging” or CSHA or Rockwood or Videx or Dalhousie or “Capital District Health Authority” or CDHA) adj2 frailty adj2 (scale* or tool* or screen* or measure* or assess* or score* or index*)).tw.

Appendix 2

Included Articles

- Alfaadhel TA, Soroka SD, Kiberd BA, Landry D, Moorhouse P, Tennankore KK. Frailty and Mortality in Dialysis: Evaluation of a Clinical Frailty Scale. *Clinical Journal of the American Society of Nephrology*. 2015;10 (5):832–840. doi:<https://doi.org/10.2215/cjn.07760814>.
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Supplementary information

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Additional file 1. Supplementary figures & tables.

Abbreviation

CFS: Clinical Frailty Scale

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Authors' contributions

SC and OT directed and contributed to all aspects of this manuscript. KR contributed to study design, data interpretation and writing. ER contributed to literature search and data extraction. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Not applicable.

Consent for publication

Not applicable.

Competing interests

KR is President and Chief Science Officer of DGI Clinical, which in the last five years has contracts with pharma and device manufacturers on individualized outcome measurement. In 2017 he attended an advisory board meeting with Lundbeck. Otherwise any personal fees are for invited guest lectures and academic symposia, received directly from event organizers, chiefly for presentations on frailty. He is Associate Director of the Canadian Consortium on Neurodegeneration in Aging, which is funded by the Canadian Institutes of Health Research, and with additional funding from the Alzheimer Society of Canada and several other charities, as well as, in its first phase (2013–2018), from Pfizer Canada and Sanofi Canada. He receives career support from the Dalhousie Medical Research Foundation as the Kathryn Allen Weldon Professor of Alzheimer Research, and research support from the Canadian Institutes of Health Research, the QEII Health Science Centre Foundation, the Capital Health Research Fund and the Fountain Family Innovation Fund of the QEII Health Science Centre Foundation. All other authors declare that they have no competing interests.

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