The Journal of Frailty & Aging 14 (2025) 100033

Contents lists available at ScienceDirect

The Journal of Frailty & Aging

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

Review

A systematic review of assessment tools for cognitive frailty: Use, psychometric properties, and clinical utility ☆

Kate Dobie[a,*], Christopher J. Barr[a], Stacey George[a,b], Nicky Baker[a], Morgan Pankhurst[a], Maayken Elizabeth Louise van den Berg[a]

[a] Caring Futures Institute, College of Nursing and Health Sciences, Flinders University, GPO Box 2100, Adelaide, 5001, South Australia, Australia
[b] Adelaide Primary Health Network, Level 1/22 Henley Beach Road Mile End SA 5031, Australia

ARTICLE INFO

Keywords:
Cognitive Impairment
Frailty
Adult
Cognitive Frailty

ABSTRACT

Background: The concept of 'cognitive frailty' (CF) was first developed by an international consensus group in 2013 and defined as evidence of both physical frailty and cognitive impairment without a clinical diagnosis of AD or another dementia. CF has been associated with adverse health outcomes and early identification is vital. Difficulty in the assessment of CF however is the lack of a diagnostic gold standard. *Objectives:* This review aimed to identify assessment tools used to diagnose cognitive impairment in the diagnosis of cognitive frailty, their psychometric qualities and clinical utility. *Research design and methods:* Six databases were searched between 2013–2024. Studies were eligible if they reported a method of defining cognitive frailty, named the assessment tools, and stated cutoff values used to define cognitive impairment. *Results:* In the 116 included studies, large heterogeneity was found in the tools utilised, and cutoff scores applied, to diagnose cognitive impairment in the diagnosis of cognitive frailty. This review has demonstrated that diagnosis of CF relies predominantly on the use of three cognitive assessment tools (Mini Mental State Examination, Montreal Cognitive Assessment, Clinical Dementia Rating) from a total of 22 different tools identified in the literature. For assessment of physical frailty, 11 different tools were identified, with the Fried Frailty Index and FRAIL Scale predominantly utilised. *Discussion and Implications:* The variation in the tools used to identify the diagnosis of CF means there is inconsistency in reporting, potentially impacting both the understanding of the prevalence, and the appropriate direction of intervention strategies.

1. Background

Globally by 2030, one in six people in the world will be aged 60 years or over (1.4 billion) and by 2050, this will double, and include 426 million persons aged over 80 years [1]. Prevalence of frailty in a global population aged over 50, has been reported as high as 24% and the prevalence of pre-frailty is estimated at 49% [2].

The term 'frail elderly' has been a Medline Medical Subject Heading (MeSH) heading since 1991, yet there was initially much debate as to whether 'frailty' was a standalone concept [3]. In 2001 two main concepts and assessment tools to assess frailty were put forward. Firstly, Fried et al. suggested a way to assess and identify frailty as a medical condition based on a 'phenotype' concept [4], and secondly, in the same year Mitniski and colleagues introduced their 'accumulation of deficits' measure [5]. Whilst there remains no single way to identify physical frailty, a variety of additional assessment tools have been developed [6], and an international consensus was formed, defining physical frailty as a syndrome that can be potentially prevented and treated. In addition, given the development of rapid and simple screening tests, it was recommended that all people over 70 should be screened for frailty [7].

With the increase of research into physical frailty [3], it has become evident that frailty increases the risk of other, often aged related, conditions such as changes in cognition [8], falls [9] and poor health outcomes [10]. People presenting with concurrent decline in cognitive function and physical frailty are more likely to develop disability in activities of daily living, compared to people with physical frailty or cognitive impairment alone, [11]. People with concurrent cognitive decline and physical frailty also have a higher prevalence of falls, poorer quality of life and have a fivefold increased mortality risk [12] compared to the general older population [9,13].

☆ The Author(s) received no financial support for the research, authorship, and/or publication of this article. Ethics approval was not required for this study, as it was a systematic review. Consent from participants was also not required due to the nature of this study.

* Corresponding author.
E-mail addresses: dobi0017@flinders.edu.au (K. Dobie), chris.barr@flinders.edu.au (C.J. Barr), stacey.george@flinders.edu.au (S. George), nicky.baker@flinders.edu.au (N. Baker), morgan.pankhurst@flinders.edu.au (M. Pankhurst), maayken.vandenberg@flinders.edu.au (M.E.L. van den Berg).

https://doi.org/10.1016/j.tjfa.2025.100033
Received 7 November 2024; Received in revised form 13 January 2025; Accepted 14 February 2025
Available online 9 March 2025

In 2013 an International Consus group from the International Academy of Nutrition and Aging (IANA) and the International Association of Gerontology and Geriatrics (IAGG), formed and agreed upon the concept of 'Cognitive frailty' (CF). It was defined as the simultaneous existence of both physical frailty and cognitive impairment, demonstrated by clinical presence of both physical frailty and cognitive impairment, with a Clinical Dementia Rating (CDR) = 0.5 and exclusion of concurrent Alzheimers Disease (AD) dementia or other dementias, [14]. They noted their definition was not an operational model, stating "…the consensus group proposed the hypothesis of a possible new condition. There was no intention of operationalizing it,….." (p733) [14]. This has resulted in a variety of assessment tools and interpretations of operational ways to identify and assess CF in clinical practice. Several studies have recognised that in the absence of a single neuropsychological measure of CF being considered gold standard, research is required to identify the best available neuropsychological battery. Factors to take into consideration include psychometric properties, such as sensitivity and specificity, as well as factors impacting on clinical utility, such as time to administer the test, and the option to tailor the test to the patient's age [15].

2. Objectives

There is a building body of research into CF, with a rapid increase in papers published on the topic from 100 in 2013 to over 350 in 2020 [16]. However, the lack of an operational model and consensus on standard assessment tools to assess CF, impacts practice through the inability to advocate for assessment as part of routine practice, incongruence in reporting of prevalence and difficulty comparing research on interventions due to diversity in assessment tools. Our review aims to establish which assessment tools are currently being used to assess cognitive impairment when diagnosing CF, and review their psychometric qualities and clinical utility.

3. Research design and method

The systematic review followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines [17]. The protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO CRD42023495797).

3.1. Search strategy

A systematic search was conducted in the electronic databases MEDLINE, PsychInfo, Ageline, EMCARE, Scopus and CINAHL. The search was limited to papers published between 2013 to August 2024. The cutoff date of 2013 was chosen due to the definition of cognitive frailty being introduced in 2013 by the IANA and IAGG [14]. To capture all relevant papers, broad search terms were used including MeSH terms and key words, an example of the MEDLINE data base search is provided below in Supplementary data- Figure 1.

Papers were filtered and included for full text review if the study cohort were referred to as having concurrent memory/decline/dysfunction/ impairment/loss/degeneration and physical frailty. Citations were downloaded and duplicate citations were removed in EndNote 20 (Clarivate, 2013) prior to screening. Further duplicates were removed by Covidence systematic review software (Veritas Health Innovation, 2023) and manually during screening.

3.2. Inclusion and exclusion criteria

Papers were eligible for inclusion if they provided a definition of CF (including reversible and potentially reversible cognitive frailty) and named the assessment tools, including cutoff scores used to define cognitive impairment and physical frailty. Papers that assessed CF either in the general population or in specific patient populations were included. Primary research and study protocols were included, however systematic review, conference abstracts, statements, and dissertations were excluded. Papers unavailable in full or English were also excluded.

Papers were excluded at full text review if they referred to the concurrence of physical frailty and cognitive impairment, but did not use the term CF to define their cohort, did not describe how they defined CF, or defined CF in ways other than the IANA and IAGG definitions, [14]. Papers that included people with dementia, delirium or transient cognitive issues were also excluded. Papers that did not present cutoff scores used to define cognitive impairment and frailty, only presented normative ranges, or referred to other research for cutoff scores, were excluded.

3.3. Data extraction

All eligible papers were screened by title and abstract, and full text review by K.D. and second reviewers (M.B., C.B., S.G. and N.B.). Data from papers deemed eligible for inclusion was systematically extracted and entered into a standardized *a priori* form developed using Microsoft Excel. Data extracted included author, publication date, country of origin, study design, population demographics, tools and cutoff scores used to assess cognitive impairment and frailty. This form and process was tested by two researchers (K.D. and M.B.) and then completed by one (K.D.).

3.4. Risk of bias

The COSMIN Risk of Bias Checklist [18,19], was used to rate the methodological quality of the research study and psychometric evidence for the most frequently utilized assessment tools. The COSMIN tool uses a four-point rating scale including very good, adequate, doubtful and poor, with overall rating per psychometric property derived from the lowest rating of any criteria for each psychometric property [18,19]. Appraisal and scoring were completed independently by two reviewers (K.D. and M.P.) who then achieved consensus on a final score. Information on the psychometric properties and clinical utility of the cognitive assessment tools was obtained by sourcing the original research study, referenced in the papers included in this systematic review, or retrieved through a hand search.

4. Results

A total of 14,498 citations were identified, of which 477 full text papers were screened for eligibility (Fig. 1 PRIMSA Flowchart). One hundred and sixteen papers, published by 101 different first authors, were deemed eligible for inclusion. Ninety-six of these were published from 2020 onwards, n=12 (10%) in 2022 and n=24 (21%) in 2024. The majority (n=53, 46%) of papers were from China, ten (9%) from Malaysia, followed by Japan (n=8, 7%) and Korea (n=7, 6%), then Italy, Tiawan & Thailand each contributing six (5%) papers. Most papers (n=62, 54%) were cross-sectional, followed by 35 (30%) cohort studies, thirteen (11%) randomised controlled trials (RCTs), and four (3%) were study protocols. A table presenting the characteristics of all included papers can be found in the Supplementary data.

4.1. Tools used to assess cognitive impairment in the diagnosis of cognitive frailty

In the 116 included papers, a total of 22 assessment tools were identified used to diagnose cognitive impairment in the diagnosis of CF, see Table 1 Tools used to assess cognitive impairment in a diagnosis of CF. Three assessment tools were most frequently used, the Mini Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA) and the Clinical Dementia Rating (CDR).

The MMSE was used most frequently in 52 (45%) of the papers. The MMSE was used as a standalone cognitive assessment tool in 45 papers

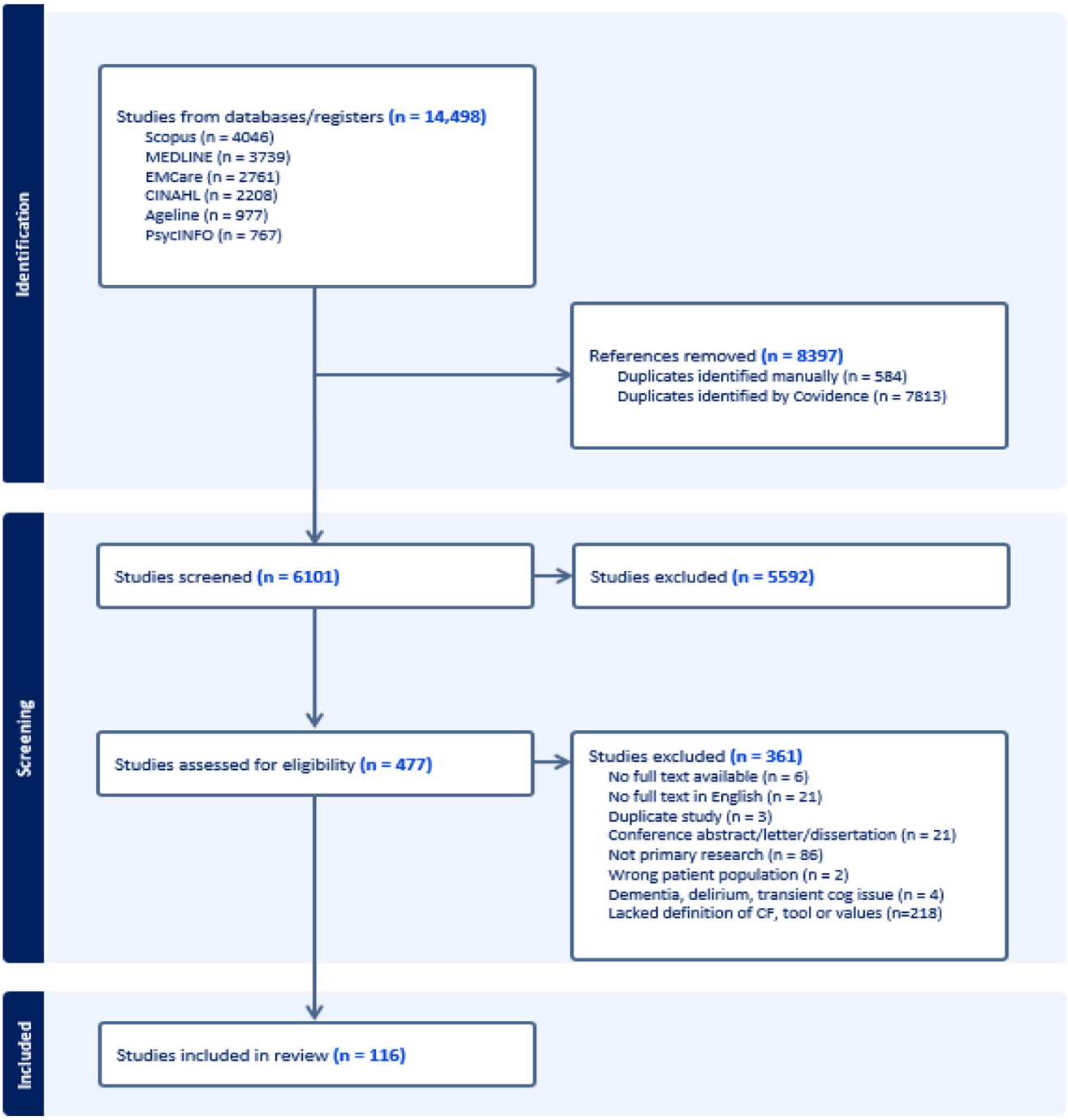

Fig. 1. PRIMSA Flowchart.

and in combination with other cognitive assessment tools in seven papers, (refer to Table 1). The Montreal Cognitive Assessment (MoCA) and Clinical Dementia Rating (CDR) were used in 32 (28%) and 21 (18%) papers respectively. The MoCA was used as a standalone assessment tool in 22 papers and in combination with another cognitive assessment tools in ten papers. The CDR was referenced in 13 papers as a standalone assessment and in eight papers with other cognitive assessments. Acknowledging the MMSE has been noted to be impacted by age, education and cultural background [20], 14 papers used language adapted versions and 23 papers allowed variance for education levels by using education-adjusted MMSE scores. The MoCA Basic was used in two papers [21,22] and is an adapted form of the MoCA, reported as having high validity and accurate screening for Mild Cognitive Impairment (MCI) in poorly educated older adults irrespective of literacy [23]. Many of the less frequently used assessment tools were used only in one included study, or in combination with other assessment tools, see Table 1.

4.2. *Combined use of cognitive impairment assessment tools*

In 17 (15%) papers cognitive assessment tools were used in combination with one or more other tools to assess cognitive impairment in the diagnosis of CF, see Table 2 Combinations of cognitive assessment tools used to assess cognitive impairment in a diagnosis of CF. The combination most commonly used was the CDR paired with MoCA (used together in six papers). One rationale provided for this approach was

Table 1
Tools used to assess cognitive impairment in a diagnosis of CF (n=22) from n=116 studies.

Assessment Tools	Number of uses	Usage as a single measure.	Usage in combination with another cognitive tool	Variations (number of papers variation used in)
Mini Mental State Examination (MMSE)	52 (45%)	45	7	MMSE- Cantonese version (1) MMSE- Chinese version (7) MMSE- Spanish version (1) MMSE-Bangla Adaptation (1) MMSE-DS- Dementia Screening (2) MMSE-K- Korean version (1) MMSE-Korean Version (1) MMSE-Mandarin (1) MMSE-Persian-translated (1)
Montreal Cognitive Assessment (MoCA)	32 (28%)	22	10	MoCA-B (2) MoCA-B- Thai version (2) MoCA-BJ- Beijing version (1) MoCA-Fuzhou version (2) MoCA-J (1) MoCA-T- Thai version (4)
Clinical Dementia Rating (CDR)	21 (18%)	13	8	
Mini-Cog	3 (3%)	3	0	
Simplified Subjective Cognitive Decline questionnaire (SCD)	2 (2%)	1	1	
Geriatric Depression Scale 15- item15 (GDS15)	2 (2%)	2	0	
Revised Hasegawa dementia scale (HDS-R)	2 (2%)	2	0	
Global deterioration scale (GDS)	2 (2%)	0	2	
Subjective Cognitive Decline Question- “How would you rate your memory at the present time? Would you say it is excellent, very good, good, fair or poor?”	2(2%)	2	0	
Rapid Cognitive Screen (RCS)	1 (1%)	0	1	
Geriatric Depression Scale 30-item 14 (GDS30)	1 (1%)	1	0	
Groningen Frailty Indicator (GFI)	1 (1%)	1	0	
Kihon Checklist (KCL)	1 (1%)	1	0	
Wechsler Adult Intelligence Scale III Digit-Symbol Coding Test (DSCT)	1 (1%)	1	0	
Modified mini mental (3MSE)	1 (1%)	1	0	
Trail Making Test-A (TMT-A)*	1 (1%)	0	1	
Trail Making Test-B (TMT-B)	1 (1%)	0	1	
Subjective Cognitive Decline Question- Do you think you have more problems with memory than most?’	1 (1%)	0	1	
Clock drawing test (CDT)	1 (1%)	0	1	
Korean Dementia Screening Questionnaires–Prescreening (KDSQ-P)	1 (1%)	1	0	
Short Portable Mental Status Questionnaire	1 (1%)	1	0	
Subjective Cognitive Decline Question- Do you feel that you have more problems with thinking and memory than most?”	1 (1%)	0	1	
EORTC QLQ-C30 questionnaire.	1 (1%)	1	0	

Note- Total number of uses will not sum to 116 or 100%, due to multiple combinations of assessment tools in papers.

using the CDR to exclude a diagnosis of dementia and the MoCA to assess the level of cognitive impairment [24].

4.3. Cutoff scores used in cognitive impairment assessment tools

Cutoff scores used to define cognitive impairment varied greatly between papers using the same assessment tool, except in the use of the CDR, for which the same cutoff score of 0.5 was used in all papers. There were some subtle differences in how cutoff scores were chosen, such as variation in the use of symbols (e.g. ‘equal’, ‘less than’ or a combination) and the use of a single value versus a score range, both of which contributed to the heterogeneity in cutoff scores. Twenty-seven different cutoff scores were identified for the MMSE, the highest <27 and the lowest >15, resulting in a large score difference of 14 points. Twenty-three papers that used the MMSE noted adjusted cutoff scores to reduce educational bias and this adaption to scoring was reported in nine variations. Fifteen different cutoff scores were used for the MoCA, with a difference of thirteen points between the highest (≤26) and lowest (14) cutoff scores. Seven papers that used the MoCA noted adjusted cut off scores to reduced educational bias, in five variations.

4.4. Psychometric properties and clinical utility of cognitive assessment tools

Review of psychometric properties and clinical utility were completed for the most frequently used assessment tools (MMSE, MoCA, CDR) and presented in Tables 3 and 4. Overall, the MoCA achieved higher ratings with regards to its psychometric properties than the MMSE and CDR, see Table 3 Psychometric properties of cognitive assessment tools. The internal consistency for the MoCA was ‘very good’, compared to ‘doubtful’ for the MMSE and CDR. Reliability and content validity was rated ‘adequate’ for the MoCA and ‘doubtful’ for the MMSE and CDR. Criterion validity was consistent across all three measures and rated as ‘very good’.

The clinical utility of the MMSE, MoCA and CDR are noted in Table 4 Clinical utility of cognitive assessment tools. The reported completion time is shorter for the MMSE (7–10 min) than the MoCA (10 min) and the CDR (40–70 min). Training is required to administer the MoCA and CDR but not the MMSE. All cognitive assessments measure memory and orientation, but only the MoCA assesses executive function. The CDR was the only assessment tool to measure impact of cognitive function on capacity with activities of daily living.

Table 2
Combinations of cognitive assessment tools used to assess cognitive impairment in a diagnosis of CF.

Assessment Tools	Frequency used together
Clinical Dementia Rating (CDR) and Montreal Cognitive Assessment (MoCA)	6 (5%)
Mini Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA)	2 (2%) (1 + 1x MMSE and MoCA-B)
Rapid Cognitive Screen (RCS) and Simplified Subjective Cognitive Decline questionnaire (SCD)	1(1%)
Montreal Cognitive Assessment (MoCA) and Global deterioration scale (GDS)	2 (2%)
Clinical Dementia Rating (CDR) and Mini Mental State Examination (MMSE)	2 (2%)
Mini Mental State Examination (MMSE) and Trail Making Test-A (TMT-A) and Trail Making Test-B (TMT-B)	1(1%)
Mini Mental State Examination (MMSE) or SCD = "Do you think you have more problems with memory than most?"	1(1%)
Mini Mental State Examination (MMSE) and Clock drawing test (CDT)	1(1%)
Clinical Dementia Rating (CDR) and subjective cognitive decline question "Do you feel that you have more problems with thinking and memory than most?"	1 (1%)

4.5. Tools used to assess physical impairment in the diagnosis of cognitive frailty

There was less variation in the assessment tools used to diagnose the physical frailty than the cognitive impairment component of CF. A total of 11 different assessment tools were identified, with the majority (n=74, 64%) of papers using the Fried Frailty Index [4]. The second and third most commonly used assessment tools were The FRAIL Scale[25] and Edmonton Frailty Scale (EFS) [26], reported in 25 (22%) and six (5%) papers respectively. As observed in the cognitive impairment assessments, language adapted versions were also used in the frailty assessments conducted with the FRAIL Scale (Chinese n=1, Korean n=2, Persian n=1), Edmonton Frailty Scale (Chinese, n=3) and Frailty Index (Thai, n=1).

All papers that used the Fried Frailty Index or the FRAIL scale used the standard scoring, classifying a score of 1–2 as pre-frail and a score of 3–5 as frail. Forty (34%) papers included pre-frailty in their definition of CF. Papers using the Edmonston frail Scale (EFS) defined frailty as a score of ≥5 points, and those using the Frailty Index used scores ranging between >0.21 and > 0.35. Two papers used gait speed and grip strength to measure the physical frailty component of CF and applied slightly different cutoff scores: gait speed of <1.0 m/s [27] and <0.8m/s [28] and grip strength <26 kg for men and <18 kg for women [27] compared to <28 kg for males and <18 kg for females [28].

4.6. Combination of cognitive and frailty assessment tools to diagnose CF

The large variety in cognitive assessment tools and the smaller but notable variance in frailty tools used resulted in numerous combinations of tools used to define CF. The most commonly observed combination was the MMSE with Fried Frailty Index, used in 24 (20%) of papers. Of the 24 papers, eight defined CF as a Fried score of 1 or above with a MMSE score ranging between <23-<27, and 16 used a Fried score of 3 or more in combination with a MMSE score ranging between 18–27 to define CF. Three other combinations were frequently used, including the MMSE with FRAIL scale (n=13, 11%), CDR with Fried Frailty Index (n=13, 11%) and the MoCA with Fried Frailty Index (n=12, 10%).

5. Discussion and implications

This is the first systematic review to determine which assessment tools are being used to diagnose cognitive impairment in a diagnosis of CF. This review also reports on the psychometric qualities and clinical utility of the most used cognitive assessment tools. The review identified 22 different assessment tools used to assess cognitive impairment in the diagnosis of CF. Whilst this number is high, only three assessment tools (MMSE, MoCA and CDR) were frequently included in the majority of papers (91%). The range between lowest and highest cutoff scores for the MMSE was 14 points, and for the MoCA this was thirteen points. A total of 11 different assessment tools were identified to assess frailty in CF, with the Fried Frailty Index being the most commonly used, in 49 (60%) papers. Most studies defined cognitive frailty using a combination of a Fried score of 3 or higher and a MMSE score ranging from 18 to 27.

Several factors may have influenced the choice of cognitive assessment tool used in the papers included in this review. Most papers (84%) adopted cross sectional and cohort designs, suggesting that defining CF was not the primary purpose of the original data set. The MMSE and the MoCA may have been used to diagnose cognitive impairment in CF because they are the most commonly used cognitive assessment tools for older people [29,30], and available and familiar to most users. The original definition of CF by Kelaiditi and colleagues referred to the CDR, which may have contributed to the frequent use of this assessment tool. By definition the cognitive impairment in CF is 'mild', and whilst the MoCA is noted as being sensitive and specific to measuring MCI [31], the MMSE has been found to have poor sensitivity for detecting early cognitive changes [32]. CDR scores have also been found to poorly correlate with MCI, with an exception of the severe end of MCI [33]. The disconnect between the low psychometric properties and high frequency of use may indicate that cognitive assessment tools may have been utilised due to their relative ease of use and accessibility, as opposed to their sensitivity and suitability for use as a diagnostic tool in CF.

Great variation was observed in the cutoff scores used to identify cognitive impairment in the diagnosis of CF. Varied cutoff points, and a lack of standardized scores, has been previously reported for the MMSE [34], leading to a recommendation that it is best used as a screening tool rather than a diagnostic tool. A cutoff score of 26 is generally recommend for the MoCA [35], however scores between 23–25 have been reported to more accurately detect MCI in certain ethnic groups, [36]. In older Chinese people, a cutoff 25/26 has found to have higher sensitivity, whereas a cutoff of 24/25 has been reported to provide higher specificity for detecting MCI [37]. Adapting and choosing cutoff scores to address ethnic variance or detect MCI may have increased the variety of cutoff scores in this study and should be considered when aiming for consensus in assessment tools and cutoffs in a diagnosis of CF. Variation in scores also related to the use of single scores compared to a cutoff range. Cutoff ranges with a lower boundary, such as MMSE 19–26 [38] or 25–17 in the MoCA-J [39], ensure only the inclusion of MCI. This is important to inform clinical practice in diagnosing CF and avoid the inclusion of people with moderate /severe cognitive impairment or de-

Table 3
Psychometric properties of cognitive assessment tools.

Tool	Internal consistency	Reliability	Content validity	Structural validity	Cross cultural	Criterion Validity	Responsiveness
MoCA [35]	V	A	A	D	D	V	D
MMSE [49]	D	D	D	D	N/A	V	D
CDR [50]	D	D	D	D	N/A	V	D

Score: V= very good; A = adequate; D = doubtful; I = inadequate; N/A= not applicable

Table 4
Clinical utility of cognitive assessment tools.

Tool/ Area of assessment	Memory	Orientation	Executive function	Language	Visuospatial	Attention	Functional capacity with activities of daily living	Time to complete (mins)	Training required to administer
MMSE	+	+	-	+	+	+	-	7–10	No
MoCA	+	+	+	+	+	+	-	10	Yes
CDR	+	+	-	-	-	-	+	40–70	Yes

MMSE= Mini Mental State Examination, MoCA= Montreal Cognitive Assessment, CDR=Clinical Dementia Rating [46–48]

mentia. The difference of one point due to using symbols to indicate 'less than' rather than 'equal or less than' in a cutoff score, is unlikely to impact a diagnosis of cognitive impairment. However, to assist effective clinical use cutoff points should be clearly defined.

The three most used assessment tools (MMSE, MoCA and CDR) have common areas of cognitive assessment in their structure (e.g. memory, attention) but their content also varies, which impacts on how CF is being diagnosed and reported. For example, the CDR is used by clinicians as a staging tool for Dementia, and whilst it shares common areas of cognitive assessment such as memory, this score is determined by the clinician [40] not participant performance on a standardised test, unlike in the MoCA [35] and MMSE [20]. The CDR also includes assessment of reported ability in areas such as 'home and hobbies' and 'personal care', which are highly relevant for staging the impact dementia is having on a person's life and could potentially be relevant for any manifestation of SCD in function, but it is not included in the MMSE and MoCA which only objectively assess cognitive ability. When discussing consensus on the assessment tools to diagnose CF, the inclusion of assessment tools that also potentially measures the impact of CF on function should be considered.

Review findings demonstrated that the most commonly used (60%) assessment tool for the physical frailty component of CF was the Fried Frailty Index [4]. Several papers used a subset of the Fried criteria for assessment of frailty [27,28] such as grip strength and gait speed, and this should be considered as partof the suite of assessment tools to diagnose CF as a quicker way to identify physical frailty. There was less variation in the tools used for the assessment of physical frailty, likely because the concept of physical frailty has been long established and recognized.

Prevalence of CF has been reported as varying between 1–22% [41] and 6–16% [42]. This may be due to some definitions of CF including pre-frailty. There are emerging sub-diagnoses of CF that [43] use different diagnostic criteria, such as the absence of cognitive impairment but presence of frailty (pre-cognitive frailty) [43], or pre-frailty and MCI (potentially reversible CF) and pre-frailty and pre-MCI (reversible CF) [44]. When designing interventions for CF, the level of frailty and cognitive impairment should be considered, for example those with pre-frailty are more physically able and this may impact on the nature of the intervention as well as study outcomes.

Understanding how CF can be diagnosed, and subsequently inform therapeutic intervention, was one of the key drivers for this systematic review. Supporting clinicians in any setting to quickly and easily identify who may be cognitively frail is essential, given the adverse health outcomes associated with CF such as increased falls risk [45]. Review of the clinical utility of the three most utilized assessment tools (MMSE, MoCA, CDR) indicated that the MoCA has superior sensitivity to detect MCI, when compared to the MMSE [35]. However, accredited training is required to conduct the MoCA, as well as the CDR [46] which may be a limiting factor towards the broader use of these tools. Time to complete assessment is an important factor when selecting an assessment tool in clinical practice. The CDR takes 40–70 min [46] to complete, compared to 7–10 min for a MoCA or MMSE [47]. The Mini-Cog was used in three papers in this review and the clock drawing test used in one. Both of these tests only take three minutes to complete and have been found to detect early mild neurocognitive disorder [48]. A shorter assessment tool such as these, which indicates a deviation from normal cognition and rule out more severe impairment, could be all that is required to assess MCI in a diagnosis of CF.

6. Limitations

Whilst this review included a large number of papers, the inclusion and exclusion criteria used may have led to a selection bias and potentially excluded papers that utilized other assessment tools.

The authors completed a review of psychometric properties using the COSMIN protocol and sourced original papers describing the assessment tools. The MMSE was first published in 1975, changes in reporting standards may have influenced COSMIN ratings for this tool.

7. Conclusion

This review has demonstrated that diagnosis of CF relies predominantly on the use of three cognitive and two physical assessment tools, from a total of 22 and 11 identified in the literature respectively. The variation in the tools used to identify cognitive impairment in the diagnosis of CF means there is inconsistency in the reporting of CF, potentially impacting both the understanding of the prevalence, and the appropriate direction of intervention strategies. Amongst the cognitive assessment tools identified there was a wide variance as to how they were utilized to diagnose CF. Agreement on both the suite of assessment tools used and their cutoff points for diagnostic use is recommended to support a cohesive international approach to diagnosing and treating CF.

Declaration of competing interest

The Authors declare no conflict of interest.

CRediT authorship contribution statement

Kate Dobie: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Christopher J. Barr:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Stacey George:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation. **Nicky Baker:** Writing – review & editing, Formal analysis, Data curation. **Morgan Pankhurst:** Writing – review & editing, Methodology, Formal analysis. **Maayken Elizabeth Louise van den Berg:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Data curation, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.tjfa.2025.100033.

References

[1] WHO WHO. *Ageing and health*. 2022. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

[2] O'Caoimh R, Sezgin D, O'Donovan MR, et al. Prevalence of frailty in 62 countries across the world: a systematic review and meta-analysis of population-level studies. Age Ageing 2020;50 10/17. doi:10.1093/ageing/afaa219.
[3] Bergman H, Ferrucci L, Guralnik J, et al. Frailty: an emerging research and clinical paradigm—issues and controversies. J Gerontol: Ser A 2007;62(7):731–7. doi:10.1093/gerona/62.7.731.
[4] Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol: Ser A 2001;56(3):M146–57. doi:10.1093/gerona/56.3.M146.
[5] Mitnitski AB, Mogilner AJ, Rockwood K. Accumulation of deficits as a proxy measure of aging. ScientificWorldJournal 2001;1:321027 1900/01/01. doi:10.1100/tsw.2001.58.
[6] Faller JW, Pereira DDN, de Souza S, Nampo FK, Orlandi FS, Matumoto S. Instruments for the detection of frailty syndrome in older adults: a systematic review. PLoS One 2019;14(4):e0216166. doi:10.1371/journal.pone.0216166.
[7] Morley JE, Vellas B, van Kan GA, et al. Frailty consensus: a call to action. J Am Med Dir Assoc Jun 2013;14(6):392–7. doi:10.1016/j.jamda.2013.03.022.
[8] Panza F, Lozupone M, Solfrizzi V, et al. Different cognitive frailty models and health- and cognitive-related outcomes in older age: from epidemiology to prevention. Review. J Alzheimer's Dis 2018;62(3):993–1012. doi:10.3233/JAD-170963.
[9] Salari N, Darvishi N, Ahmadipanah M, Shohaimi S, Mohammadi M. Global prevalence of falls in the older adults: a comprehensive systematic review and meta-analysis. J Orthop Surg Res 2022;17(1):334 2022/06/28. doi:10.1186/s13018-022-03222-1.
[10] Hoogendijk EO, Afilalo J, Ensrud KE, Kowal P, Onder G, Fried LP. Frailty: implications for clinical practice and public health. Lancet 2019;394(10206):1365–75. doi:10.1016/S0140-6736(19)31786-6.
[11] Avila-Funes JA, Amieva H, Barberger-Gateau P, et al. Cognitive impairment improves the predictive validity of the phenotype of frailty for adverse health outcomes: the three-city study. J Am Geriatr Soc Mar 2009;57(3):453–61. doi:10.1111/j.1532-5415.2008.02136.x.
[12] Feng L, Zin Nyunt MS, Gao Q, Feng L, Yap KB, Ng T-P. Cognitive frailty and adverse health outcomes: findings from the Singapore Longitudinal Ageing Studies (SLAS). J Am Med Dir Assoc 2017;18(3):252–8. doi:10.1016/j.jamda.2016.09.015.
[13] Guo CY, Sun Z, Tan CC, Tan L, Xu W. Multi-concept frailty predicts the late-life occurrence of cognitive decline or dementia: an updated systematic review and Meta-analysis of longitudinal studies. Front Aging Neurosci 2022;14:855553. doi:10.3389/fnagi.2022.855553.
[14] Kelaiditi E, Cesari M, Canevelli M, et al. Cognitive frailty: rational and definition from an (I.A.N.A./I.A.G.G.) International Consensus Group. J Nutr Health Aging 2013;17(9):726–34 2013/11/01. doi:10.1007/s12603-013-0367-2.
[15] Mantovani E, Zucchella C, Schena F, Romanelli MG, Venturelli M, Tamburin S. Towards a redefinition of cognitive frailty. J Alzheimers Dis 2020;76(3):831–43. doi:10.3233/JAD-200137.
[16] Hui Z, Wang X, Zhou Y, Li Y, Ren X, Wang M. Global Research on Cognitive Frailty: a bibliometric and visual analysis of papers published during 2013–2021. Int J Environ Res Public Health 2022;19(13):8170. doi:10.3390/ijerph19138170.
[17] Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi:10.1136/bmj.n71.
[18] Mokkink LB, de Vet HCW, Prinsen CAC, et al. COSMIN risk of bias checklist for systematic reviews of patient-reported outcome measures. Qual Life Res May 2018;27(5):1171–9. doi:10.1007/s11136-017-1765-4.
[19] Mokkink LB, Boers M, van der Vleuten CPM, et al. COSMIN risk of Bias tool to assess the quality of studies on reliability or measurement error of outcome measurement instruments: a Delphi study. BMC Med Res Methodol Dec 3 2020;20(1):293. doi:10.1186/s12874-020-01179-5.
[20] Tombaugh TN, McIntyre NJ. The mini-mental state examination: a comprehensive review. J Am Geriatr Soc Sep 1992;40(9):922–35. doi:10.1111/j.1532-5415.1992.tb01992.x.
[21] Wongtrakulruang P, Muangpaisan W, Panpradup B, Tawatwattananun A, Siribamrungwong M, Tomongkon S. The prevalence of cognitive frailty and pre-frailty among older people in Bangkok metropolitan area: a multicenter study of hospital-based outpatient clinics. J (Basel) Sep 2020;5(3):62–71. doi:10.22540/JFSF-05-062.
[22] Griffiths J, Seesen M, Sirikul W, Siviroj P. Malnutrition, depression, poor sleep quality, and difficulty falling asleep at night are associated with a higher risk of cognitive frailty in older adults during the COVID-19 restrictions. Nutrients Jun 23 2023;15(13):23. doi:10.3390/nu15132849.
[23] Julayanont P, Tangwongchai S, Hemrungrojn S, et al. The Montreal Cognitive Assessment-Basic: a screening tool for mild cognitive impairment in illiterate and low-educated elderly adults. J Am Geriatr Soc Dec 2015;63(12):2550–4. doi:10.1111/jgs.13820.
[24] Wan M, Xia R, Lin H, et al. Volumetric and diffusion abnormalities in subcortical nuclei of older adults with cognitive frailty. Front Aging Neurosci 2020;12:202 28, 2020. doi:10.3389/fnagi.2020.00202.
[25] Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ Aug 30 2005;173(5):489–95. doi:10.1503/cmaj.050051.
[26] Rolfson DB, Majumdar SR, Tsuyuki RT, Tahir A, Rockwood K. Validity and reliability of the Edmonton Frail Scale. Age Ageing Sep 2006;35(5):526–9. doi:10.1093/ageing/afl041.
[27] Kamasaki T, Otao H, Hachiya M, et al. Social functioning and life-related domains associated with cognitive frailty in older adults. Phys Occupat Ther Geriatr 2023;41(3):331–46. doi:10.1080/02703181.2022.2138678.
[28] Tseng SH, Liu LK, Peng LN, Wang PN, Loh CH, Chen LK. Development and validation of a tool to screen for cognitive frailty among community-dwelling elders. J Nutr Health Aging 2019;23(9):904–9. doi:10.1007/s12603-019-1235-5.
[29] Tuch G, Soo WK, Luo KY, et al. Cognitive assessment tools recommended in geriatric oncology guidelines: a rapid review. Curr Oncol Oct 8 2021;28(5):3987–4003. doi:10.3390/curroncol28050339.
[30] Chin A-V, Gray WK, Rosli R, Subramanian P, Tan MP. Cognitive assessment tools in Asia: a systematic review. Int Psychogeriatr 2016;28(2):189–210. doi:10.1017/S1041610215001635.
[31] Islam N, Hashem R, Gad M, et al. Accuracy of the Montreal Cognitive Assessment tool for detecting mild cognitive impairment: a systematic review and meta-analysis. Alzheimer's Dement 2023;19(7):3235–43 2023/07/01. doi:10.1002/alz.13040.
[32] Salis F, Costaggiu D, Mandas A. Mini-mental State examination: optimal cut-off levels for mild and severe cognitive impairment. Geriatrics Jan 12 2023;8(1). doi:10.3390/geriatrics8010012.
[33] Woolf C, Slavin MJ, Draper B, et al. Can the clinical dementia rating scale identify mild cognitive impairment and predict cognitive and functional decline? Dement Geriatr Cogn Disord 2016;41(5-6):292–302. doi:10.1159/000447057.
[34] Lopez MN, Charter RA, Mostafavi B, Nibut LP, Smith WE. Psychometric properties of the Folstein mini-mental state examination. Assessment Jun 2005;12(2):137–44. doi:10.1177/1073191105275412.
[35] Nasreddine ZS, Phillips NA, Bedirian V, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc Apr 2005;53(4):695–9. doi:10.1111/j.1532-5415.2005.53221.x.
[36] Milani SA, Marsiske M, Cottler LB, Chen X, Striley CW. Optimal cutoffs for the Montreal Cognitive Assessment vary by race and ethnicity. Alzheimers Dement 2018;10:773–81. doi:10.1016/j.dadm.2018.09.003.
[37] Sun R, Ge B, Wu S, Li H, Lin L. Optimal cut-off MoCA score for screening for mild cognitive impairment in elderly individuals in China: A systematic review and meta-analysis. Asian J Psychiatr Sep 2023;87:103691. doi:10.1016/j.ajp.2023.103691.
[38] Kim H, Awata S, Watanabe Y, et al. Cognitive frailty in community-dwelling older Japanese people: prevalence and its association with falls. Geriatr Gerontol Int Jul 2019;19(7):647–53. doi:10.1111/ggi.13685.
[39] Sugie M, Harada K, Nara M, et al. Prevalence, overlap, and interrelationships of physical, cognitive, psychological, and social frailty among community-dwelling older people in Japan. Arch Gerontol Geriatr May-Jun 2022;100:104659. doi:10.1016/j.archger.2022.104659.
[40] Morris JC. The Clinical Dementia Rating (CDR): current version and scoring rules. Neurology Nov 1993;43(11):2412–14. doi:10.1212/wnl.43.11.2412-a.
[41] Perry Avila, Zhu, et al. Different cognitive frailty models and health- and cognitive-related outcomes in older age: from epidemiology to prevention. J Alzheimer's Dis 2018;62(3):993–1012. doi:10.3233/JAD-170963.
[42] Zhang T, Ren Y, Shen P, et al. Prevalence and associated risk factors of cognitive frailty: A systematic review and meta-analysis. Review. Front Aging Neurosci 2022:13755926. doi:10.3389/fnagi.2021.755926.
[43] Diniz BS, Lima-Costa MF, Peixoto SV, et al. Cognitive frailty is associated with elevated proinflammatory markers and a higher risk of mortality. Am J Geriatr Psychiatry Jul 2022;30(7):825–33. doi:10.1016/j.jagp.2022.01.012.
[44] Ruan Q, Xiao F, Gong K, et al. Prevalence of cognitive frailty phenotypes and associated factors in a community-dwelling elderly population. Research support, Non-U.S. Gov't. J Nutr, Health Aging 2020;24(2):172–80. doi:10.1007/s12603-019-1286-7.
[45] Wang S, Wang M, Leung ISH, et al. The association of cognitive frailty and the risk of falls among older adults: a systematic review and meta-analysis. Int J Nurs Pract Aug 2023;29(4):e13181. doi:10.1111/ijn.13181.
[46] Agency for Clinical Innovation AGAIoH. https://aci.health.nsw.gov.au/resources/aged-health/screening-assessment-tools/older-people.
[47] McCollum L, Karlawish J. Cognitive impairment evaluation and management. Med Clin North Am Sep 2020;104(5):807–25. doi:10.1016/j.mcna.2020.06.007.
[48] Limpawattana P, Manjavong M. The mini-cog, clock drawing test, and three-item recall test: rapid cognitive screening tools with comparable performance in detecting mild NCD in older patients. Geriatrics Sep 16 2021;6(3). doi:10.3390/geriatrics6030091.
[49] Folstein FM. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:511–19.
[50] Hughes CP, Berg L, Danziger W, Coben LA, Martin RL. A new clinical scale for the staging of dementia. Br J Psychiatry 1982;140(6):566–72.