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Mapping cognitive function screening instruments for patients with heart failure: A scoping review

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Astuti Arseda[1], Tuti Pahria[2], and Titis Kurniawan[2*]

[1] Master of Nursing Program, Faculty of Nursing, Universitas Padjadjaran, West Java, Indonesia
[2] Faculty of Nursing, Universitas Padjadjaran, West Java, Indonesia

Abstract

Background: Patients with heart failure (HF) often experience cognitive impairment, which negatively affects their quality of life. An effective screening tool is essential for nurses and healthcare professionals to assess cognitive function as part of HF management. Although many instruments exist, none are specifically designed for patients with HF.
Objective: This study aimed to map the instruments for screening cognitive function in patients with HF.
Design: A scoping review.
Data Sources: Articles published between 2019 and 2023 were searched in PubMed, ScienceDirect, and Google Scholar, with the last search conducted on 27 January 2024.
Review Methods: The review followed the scoping review framework by Arksey and O'Malley and adhered to PRISMA guidelines for scoping reviews.
Results: Of the 21 articles meeting inclusion criteria, six cognitive function screening instruments were used across various cognitive domains, effectively identifying cognitive impairment in both inpatient and outpatient HF settings. The Montreal Cognitive Assessment (MoCA) was the most frequently used tool, covering a broad range of cognitive domains. MoCA showed high efficacy with a kappa coefficient of 0.82, Cronbach's alpha reliability of 0.75, sensitivity of 90%, and specificity of 87%.
Conclusion: Instruments like MoCA, Mini-Cog, and TICS-m show promise for assessing cognitive function in patients with HF, each with specific strengths and limitations. MoCA is notable for its comprehensive coverage despite being time-consuming and having language barriers. Further research is needed to revalidate and improve the existing instruments. It is crucial for nurses and healthcare professionals to integrate these tools into regular patient management, highlighting the need for continued research in their application.

Keywords

cognition; cognitive screening; heart failure; hospitals; delivery of healthcare

*Corresponding author:
Titis Kurniawan, S.Kep., Ners., MNS
Faculty of Nursing, Universitas Padjadjaran, Jalan Ir. Soekarno KM 21, Hegarmanah, Jatinangor, Kabupaten Sumedang, Jawa Barat, Indonesia
Email: t.kurniawan@unpad.ac.id

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Background

Cognitive function impairment among patients with heart failure (HF) is one of the most common and serious health problems. Previous studies noted that 25% to 95% of patients with HF have cognitive function impairment (Arifin, 2021; Lee et al., 2019; Rigueira et al., 2021). Cognitive function includes all processes used by individuals to organize information through sensory input from the environment, transduction (perception/visuospatial), concentration (attention), information storage (memory), verbalization, and finally, implementation of information (psychomotor) (Bostrom & Sandberg, 2009). The complicated syndrome of impaired cognitive function in patients with HF affects every body system, including the central nervous system (Rigueira et al., 2021). Thus, patients with HF with cognitive impairment may experience deficits in multiple cognitive domains, including executive function, psychomotor speed, visuospatial ability, and memory (Goh et al., 2022).

Those conditions are also closely associated with inadequate self-care (Harkness et al., 2014). Other findings report that poor cognitive function reduces patients' ability to carry out self-care maintenance, self-care management, and self-confidence (Kim et al., 2015). These studies may provide one of the main reasons why most patients with HF have inadequate self-care, as found in the most recent studies (Aghajanloo et al., 2021; Sedlar et al., 2021).

Self-care is crucial in the management of patients with HF. It refers to the practices patients adopt to preserve their health and make decisions when their symptoms worsen, including adhering to pharmacological recommendations, eating a low-salt diet, quitting smoking, limiting alcohol consumption, and daily monitoring of weight, symptoms, and decompensation (Conceição et al., 2015). Inadequate self-care leads to poor adherence to therapy and late detection of worsening symptoms in decompensated heart failure, resulting in unnecessary rehospitalizations and other complications (Dalfó-Pibernat et al., 2020). Therefore, screening patients' cognitive function is essential to improving self-care behaviors and preventing complications among patients with HF.

Nurses play essential roles in managing patients with HF, including educating patients about self-care (Dalfó-Pibernat et al., 2020). A previous study found that nurses-led education sessions for adult patients with HF effectively enhanced patients' self-care skills (Malara & Syarul, 2019). Additionally, HF-related self-care education provided by nurses significantly decreased the likelihood of readmission for any reason (Son et al., 2020). Thus, it is essential for nurses to regularly assess cognitive function among this patient group to identify strategies for determining appropriate nursing interventions, including those aimed at effectively improving patients' self-care abilities. However, cognitive function screening has not been routinely performed as part of the management of patients with HF. One reason is the lack of simple, effective, and applicable screening tools. Examining cognitive function using neuropsychological battery instruments is the gold standard, as it produces a complete picture of cognitive function. However, this method is time-consuming and clinically impractical (Goh et al., 2022). Therefore, finding or developing a more straightforward instrument to measure patients' cognitive function is necessary.

Our initial review found various instruments used for cognitive function screening, each with different capabilities to detect cognitive function impairment. There are more than 40 instruments for cognitive function screening, such as the Mini-Cog test, General Practitioner Assessment of Cognition (GPCOG), and Mini-Mental State Examination (MMSE) for general conditions (Tsoi et al., 2015). However, none of these instruments are used specifically for patients with HF (De Roeck et al., 2019).

The availability of numerous instruments provides choices for clinical practitioners, but it also poses a challenge for nurses to determine the most valid, effective, simple, and applicable for patients with HF. Short cognitive tests, such as the Montreal Cognitive Assessment (MoCA), the Mini-Cog, and the Mini-Mental State Examination (MMSE), have been used to screen global cognitive function among Asian patients with HF. However, insufficient information is available to compare the reliability of these short cognitive screening tests to a formal, gold-standard neuropsychological evaluation for patients with HF in Asia (Niu et al., 2022). Therefore, it is vital to identify the instruments that can be used to assess cognitive function among patients with HF. A clear understanding of cognitive function impairment and how to appropriately measure it is essential for nurses to care for patients with HF, including preparing them for self-care education. This scoping review aimed to map the available instruments for screening cognitive function in patients with HF.

Methods

This study utilized a scoping review following the steps outlined by Arksey and O'Malley (2005) as follows:

Identification of Research Questions

The review question was: What cognitive function screening instruments are available for patients with HF? Included in this question were the scopes of assessment, the psychometric properties, and their application. The scoping review was conducted by grouping articles on cognitive function screening instruments for patients with HF, identifying problems or gaps, and highlighting critical concepts. It was also used as a source of evidence for informing the assessment of cognitive function screening (Pham et al., 2014). The PCC (Population, Concept, Context) framework was used to develop the focus of the review and search strategy. This involved identifying key concepts related to the review focus, developing appropriate search terms to describe the problem, and determining inclusion and exclusion criteria (Peters et al., 2020). The PCC framework used was as follows: P (Population, Participant): heart failure; C (Concept): cognitive function assessment, cognitive function measure, cognitive function screening; C (Context): cognitive status, cognitive impairment.

Identification of Relevant Articles

The following databases were used to search for potential articles: PubMed, ScienceDirect, and Google Scholar. The search terms included various keyword combinations, such as cognitive OR cognition AND heart failure AND nursing, cognitive AND screening OR test OR assessment OR scanner AND heart failure AND nursing, cognitive function AND heart failure AND nursing, and cognitive disorder AND heart failure AND nursing. The three authors agreed on the keyword combinations used by the first author to search the e-databases. The last search using these keyword combinations was conducted on 27 January 2024. The details of the article search are provided in the **Supplementary File**.

Study Selection

After collecting the articles, the first author conducted a duplication check and further screened the suitability of the article titles by checking the abstracts and titles against the predefined inclusion and exclusion criteria. The inclusion criteria were 1) Applied to patients with HF, 2) Aged > 18 years, 3) English language articles, 4) Accessible full-text, and 5) Published from 2019 to 2023. The exclusion criteria included 1) Articles in the form of books, proposals, or reviews and 2) Articles that do not discuss HF. Two reviewers selected articles based on these inclusion criteria. The results of the selected articles were discussed and agreed upon with the second and third authors. The number of articles collected from all e-databases and the selection results based on the inclusion criteria were summarized using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 Flowchart (Page et al., 2021).

Charting the Data

After meeting the inclusion criteria, the articles were charted and added to a data extraction table (Arksey & O'Malley, 2005). In this scoping review, the extraction data includes information on the first author, publication year, country, research objectives, research design, description of cognitive function screening instruments (domain, number of items, specificity, and sensitivity), and settings for cognitive function screening instruments in patients with HF (**Table 1**). The goal of scoping reviews is not to provide a synthesized and clinically relevant response to a question but rather to map the available evidence (Peters et al., 2020). Therefore, the authors did not perform a risk of bias assessment or a critical appraisal.

Collecting, Summarizing, and Reporting Results

After charting the data from the articles, the researchers presented a narrative report that included the characteristics of patients involved, the research site, research design, cognitive function screening instruments, characteristics of cognitive function instruments and their domains, measures of cognitive function screening tools' sensitivity and specificity, and clinical use of cognitive function screening.

Results

Study Selection

The total search yielded 4,021 articles, comprising 289 articles from PubMed, 926 articles from ScienceDirect, and 2,806 from Google Scholar. Among these, 1,042 articles were excluded due to duplication. Title and abstract screening resulted in the filtering of 2,979 articles, resulting in 46 articles. However, 25 articles were excluded as they did not meet the inclusion criteria or lacked full text. Finally, we included and analyzed the remaining twenty-one articles. The diagram illustrating the search and article selection process is displayed in **Figure 1**.

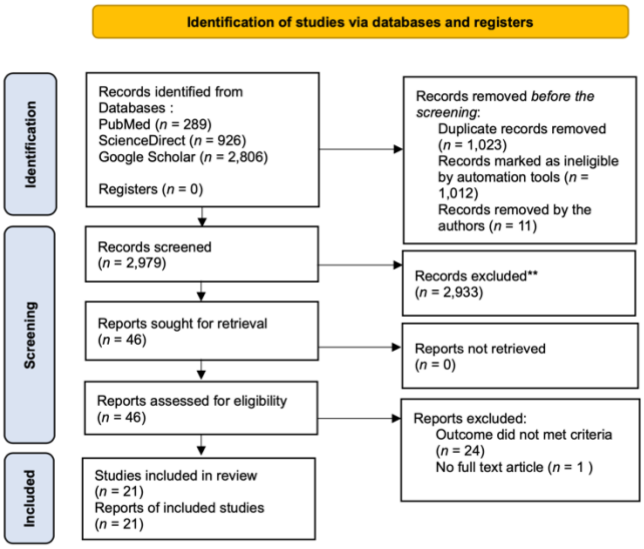

Figure 1 The process selection of the relevant articles

Characteristics of Patients with HF

The total number of respondents involved in the 21 articles was 11,385. The age of respondents ranged from 53 to 86 years, with 7,459 respondents being male (65.51%). Sixteen articles listed NYHA functional status I/II, with 2,857 respondents, and III/IV, with 4,486 respondents. The characteristics of the respondents were based on the type of HF; 14 articles examined chronic HF, and seven articles examined acute HF in the form of new HF or Acute Decompensated Heart Failure (ADHF) (Holm et al., 2020; Huynh et al., 2021; Miao et al., 2023; Pandey et al., 2019; Pastva et al., 2021; Rigueira et al., 2021; Seo et al., 2024). Three articles describe the characteristics of patients with HF from the aspect of HF reserved Ejection Fraction (HFrEF) by 2,209 respondents (Fino et al., 2020; Kuhn et al., 2022; Lee et al., 2019), and one article describes the characteristics of patients from the aspect of HF preserved Ejection Fraction (HFpEF) by 108 respondents (Sugie et al., 2018).

Country and Study Settings

The articles were collected from studies conducted in various countries. These countries include the United States (7) (Gary et al., 2019; Gharzeddine et al., 2021; Kuhn et al., 2022; Lee et al., 2019; Pandey et al., 2019; Pastva et al., 2021; Redwine et al., 2020), Netherlands (1) (Kuipers et al., 2022), Sweden (1) (Holm et al., 2020), Italy (1) (Vellone et al., 2020), Portugal (2) (Fino et al., 2020; Rigueira et al., 2021), Australia (2) (Aili et al., 2022; Huynh et al., 2021), Japan (4) (Saito et al., 2020; Seo et al., 2024; Sugie et al., 2018; Yamamoto et al., 2022),, South Korea (2) (Kim et al., 2019; Seo et al., 2023), and China (1) (Miao et al., 2023). Seven articles were in inpatient settings (Holm et al., 2020; Huynh et al., 2021; Miao et al., 2023; Pandey et al., 2019; Pastva et al., 2021; Rigueira et al., 2021; Seo et al., 2024) and the rest were in outpatient settings.

Research Design

Of the 21 articles collected, ten of them used prospective or longitudinal studies (Aili et al., 2022; Fino et al., 2020; Holm et al., 2020; Huynh et al., 2021; Kim et al., 2019; Lee et al., 2019; Miao et al., 2023; Rigueira et al., 2021; Seo et al., 2024; Yamamoto et al., 2022), one article used retrospective studies (Saito et al., 2020), five articles used Randomized Controlled Trials (RCT) (Gary et al., 2019; Kuipers et al., 2022; Pastva et al., 2021; Redwine et al., 2020; Vellone et al., 2020), and five articles used cross-sectional studies (Gharzeddine et al., 2021; Kuhn et al., 2022; Pandey et al., 2019; Seo et al., 2023; Sugie et al., 2018).

Cognitive Function Screening Instruments

The results of the scoping review in **Table 2** indicate that there were cognitive function screening instruments using paper and pencil methods or direct interviews, namely The Mini-Mental State Examination (MMSE), the Symbol Digit Modalities Test (SDMT), the Hodkinson Abbreviated Mental Test (AMT), the Montreal Cognitive Assessment (MoCA), Mini-Cog, Trail Making A and B, and A Quick Test of Cognitive Speed (AQT). Some utilize telephone media, namely the Modified Telephone Interview for Cognitive Status (TICS-m).

A total of 11 articles used MoCA as a cognitive function instrument (Aili et al., 2022; Fino et al., 2020; Gary et al., 2019; Holm et al., 2020; Huynh et al., 2021; Pandey et al., 2019; Pastva et al., 2021; Redwine et al., 2020; Rigueira et al., 2021; Seo et al., 2024; Sugie et al., 2018; Vellone et al., 2020). Four articles used MMSE (Kim et al., 2019; Lee et al., 2019; Seo et al., 2023; Seo et al., 2024). Three articles used Mini-Cog (Miao et al., 2023; Saito et al., 2020; Yamamoto et al., 2022), 3MS (Kuhn et al., 2022), AMT (Kuipers et al., 2022), and TICS-m (Gharzeddine et al., 2021) were each used in one article. Another article used MoCA with Symbol Digit Modalities Test (SDMT), Trail making A and B, and A Quick test of cognitive speed (AQT) (Holm et al., 2020). Most of the instruments in the articles in this scoping review used face-to-face interview methods, while TICS-m used telephone interview methods. Instruments with completion times < 5 minutes were the AMT, Mini-Cog, and TICS-m; 5-10 minutes were the MMSE and MoCA, and >15 minutes were the 3MS.

Table 1 Characteristics of the included studies

No	Author/Country	Purpose/Design	Population	Instrument	Domain	Findings
1	(Aili et al., 2022) Australia	To determine whether frailty and cognition can predict early death in HF Design: Prospective cohort	208 patients with HF were approved for heart transplants, outpatient	MoCA cognitive disorder score <26 out of a total score of 30	Not mentioned	When cognitive assessment is combined with physical frailty evaluation, an additional cohort of patients with an equally poor prognosis is identified
2	(Fino et al., 2020) Portugal	To explore the connection between cognitive impairment, stress, anxiety, depression, and QoL for predicting major cardiovascular events (MACCE) and patient QoL with HFrEF Design: Longitudinal	65 patients HFrEF, outpatient	MoCA Compared to MMSE, MoCA is far more sensitive in identifying mild cognitive impairment	Focused attention, executive function, memory, language, visuoconstructional thinking, computation, concept thinking, and orientation	MoCA and HRQoL can predict free survival-MACCE
3	(Gary et al., 2019) USA	To compare the effectiveness of aerobic and cognitive exercise as an intervention for memory to either exercise alone or a group of controls that participated in a stretching program Design: RCT	69 patients with HF age 40-75 years, EF ≥ 10%, outpatients, NYHA II-III MoCA score ≤ 26	MoCA Score 0-30 (26-30 is normal) MoCA was chosen for screening for better evaluation of visuospatial, executive, and cognitive vascular disorders compared to MMSE	Visuospatial and function executive	Aerobic exercise and cognitive exercise can repair memory in patients with HF
4	(Gharzeddine et al., 2021) USA	To investigate the association between HF patients' cognitive function and symptoms of insomnia Design: Cross-sectional	1,189 patients with HF, aged 61-81	A modified version of the Telephone Interview of Cognitive Status (TICS) with consistency reliability of 0.63; a composite 27-point or 35-point scale can be utilized to assess overall cognitive functioning, as the 35-point scale is exclusively given to individuals 65 years of age and above Normal (12–27); Cognitive Impaired but not Dementia (7-11); and Dementia (0-6)	immediate and delayed recall tests of memory, test of working memory attention and mental processing speed	The 27-point cognitive scale did not measure every cognitive dimension and was not a comprehensive neuropsychiatric evaluation Difficult initial sleep and early morning awake are potential indicators of decreased cognitive performance in patients with HF
5	(Holm et al., 2020) Sweden	To investigate correlations between cognitive testing and hospital readmission and death Design: Prospective cohort	281 new HF or chronic HF with recurrence, inpatients	MoCA (Score 0-30). Impairment cognitive <23 Cognitive speed (AQT), composed of 40 colors, 40 images, geometry Standard time <70 seconds attention and switching tasks (Trail making A and B). Part A draws a line between circles with numbers 1-25 in sequence to one. Part B draws a line between circles 1-14. The circle contains AL letters, such as 1-A-2- B -3-C, etc. Normal values for aged 70-74 years education 0-12 years = 42 ± 15.5, education >12 years = 40 ± 14.5 Symbol Digit Modalities Test (SDMT). Pair nine specific symbols with numbers 1-9 (Score 0-110; normal ≥90)	MoCA covers eight domains: executive, language, abstract, orientation, short- and long-term memory, attention, and visuospatial. AQT: visual stimulation Trail-making assessment: executive function, visual search, scanning, mental flexibility, and speed processing SDMT: attention, visual scanning, motor speed, learning association	The results of the MoCA and SDMT tests are correlated with the death of patients with HF at home pain, and the results of the MoCA test are related to rehospitalization

Table 1 *(Cont.)*

6	(Huynh et al., 2021) Australia	To identify patients with cognitive impairments most likely get benefit from HF management programs for parse readmission Design: Prospective studies	1152 patients with HF admitted to the hospital, aged >18 years	MoCA, Direct interview Detect mild cognitive impairment with a sensitivity of 90% and specificity of 87%. Categorized as: Moderate severe (≤16), Mild (17-22), Normal (23-25), Low (26-30)	Not mentioned	Response to disease management programs in patients with HF may depend on their cognitive function Individualized plans for patients with varying levels of cognitive function may be possible with cognitive screening before disease management program implementation
7	(Kim et al., 2019) South Korea	To investigate the connection between HRQL, depressive symptoms, self-care maintenance, and confidence Design: Prospective	117 patients with HF, ≥45 years, treated road	Korean Mini-Mental (K-MMSE) Score 0-30 Seoul Verbal Learning Test Trail Making A and B	Seoul Verbal Learning Test: Measure memory immediately and memory delayed Trail making: Function executive	Memory loss was found to harm health-related quality of life and poor executive function, increasing the likelihood of major events Cognitive function is a significant factor in major events and health-related quality of life
8	(Kuhn et al., 2022) USA	To evaluate the connection between Health literacy, function, and mortality in HF Design: Cross-sectional	298 patients HFrEF, aged 50-85 years, NYHA II-III, Outpatient	Modified Mini-Mental Status Examination (3MS) Score 0-100 Impairment cognitive light score <95	Orientation, memory/word learning, copying form geometry, delayed word recall, function executive, naming animal	Better cognitive function can predict HF deaths than Health literacy
9	(Kuipers et al., 2022) Netherland	To determine which patients with HF are most likely to have cognitive impairment Design: RCT	611 patients, ≥ 60 years, HF, NYHA II to above, take care of road	Hodkinson Abbreviated Mental Test (AMT) Score ≤7 cognitive disorders Equivalent to MMSE	Not mentioned	Patients with HF are at high risk of experiencing cognitive impairment, but validation of external weak
10	(Lee et al., 2019) USA	To determine cognitive decline as systolic patients with HF over time Design: Longitudinal study/ cohort	1846 patients with HF ≤ 35%, age > 18 years, outpatients	MMSE for estimating cognitive impairment and changing cognition from time to time Normal score ≥24	Not mentioned	Demographic factors, NYHA class, and baseline cognitive status all predict cognitive decline in HF
11	(Miao et al., 2023) China	To evaluate cognitive function in postdischarge patients with HF from the hospital for one month and research the impact after one year in patients with HF who experienced an impairment in cognitive Design: Prospective	2307 new patients with HF or ADHF, ≥ 18 years, care road	Mini-Cog, containing two components: 3-word memory items and one clock drawing item. Total score: 5 For every correct word, receive one point and two points Sensitivity is 90%, and specificity is 71% for cognitive impairment.	Not mentioned	Acute HF effect period short on cognitive function Within one month of discharge, patients who already had cognitive impairment are at a higher risk of death and returning to the hospital

Table 1 *(Cont.)*

12	(Pandey et al., 2019) USA	To assess the frequency of frailty and its connections to physical function, quality of life, cognitive function, depression, and the effectiveness of the investigation process in older patients receiving ADHF treatment Design: RCT	202 ADHF patients, ≥60 years, treated stay	MoCA Score <26 cognitive disorders	Not mentioned	No connection between weakness/frailty and MoCA
13	(Pastva et al., 2021) USA	To evaluate the prevalence impairment cognitive and cognitive subdomains affected in connection function cognitive, with function physical and QoL Design: Cross-sectional	198 ADHF patients aged ≥60 years, inpatients ≥24 hours	MoCA. It takes 10 minutes for work and burdens minimal patient count, so it is ideal for cardiovascular disease at the hospital Total score: 30. A score limit of 26 has a 90% sensitivity and a 78% specificity for mild cognitive impairment in the range of 19 to 25 mild cognitive impairment <19 related to dementia	Language, abstraction, delayed memory, naming, orientation, and visual-spatial/executive skills	Cognitive impairment is related to impairment in physique and QoL
14	(Redwine et al., 2020) USA	To explore whether mild or moderate exercise improves cognitive function in HF Design: RCT	69 symptomatic patients with HF with clinical stability, outpatients	MoCA Time to use 10 minutes Score 0-30 One score added to education <12 years Sensitivity 64% and specificity 66% for detection impairment cognitive when compared to battery neuropsychology complete	Short memory, function executive, verbal abstraction, visuospatial, memory work, concentration, attention, language and orientation	Mild and moderate exercise repair cognitive function
15	(Rigueira et al., 2021) Portugal	To evaluate the prognostic significance of HF patients' cognitive state over time, as well as their associations with anxiety and depression Design Prospective	43 acute patients with HF (new or ADHF) post-hospitalization stay	MoCA Inspection function cognitive entered in 2016 ESC guidelines Score 30. Score <22 cognitive disorders For the population of Portuguese	Temporal and spatial orientation, executive function, visuospatial function, short-term memory, language, attention, focus, and memory work	A score of MoCA <22 posts discharge correlates with six times risky tall readmission consequences of HF, predict readmission all outcomes, and death. High MoCA score capable of facing the disease. MoCA scores do not relate to anxiety and depression
16	(Saito et al., 2020) Japan	To assess whether cognitive impairment provides additional information in parents with HF Design: Multicenter retrospective studies	352 patients with HF aged ≥75 years, outpatient	Mini-Cog, containing three memory items and a clock drawing Officer Health requested that the patient repeat three words that were not related. Then, the patient was requested to draw the hour and remember the previous three words that had been repeated Total score: 5. Every right word earns one point, and the clock image earns two points. Impairment cognitive ≤2 MMS. Score 0-30 (Impairment cognitive <24)	Orientation, word learning and memory, and picture geometry copying.	Impairment cognitive is a factor critical for the prediction of prognosis in older people with HF Mini-Cog is a handy tool for evaluating cognitive impairment and providing more prognostic information

Table 1 *(Cont.)*

17	(Seo et al., 2024) Japan	To explain prognostic value function-related cognition in patients with ADHF and associated factors abnormality cognition in ADHF patients Design: Prospective	274 ADHF patients, inpatients	MMSE It contains 11 questions Score 0-30 Category: 0-23 interference cognitive, 24-27 light cognitive disorders, 28-30 is normal Used by ESC 2016 guidelines	Not mentioned	Even impairment cognitive light risky in a way significant incident cardiac in ADHF The risk most from being admitted to the hospital due to HF, which is not planned
18	(Seo et al., 2023) South Korea	To investigate the connection between duration of sleep and weakness physique with function cognition in atrial fibrillation and HF Design: Cross-sectional	176 patients with AF and HF, age ≥ 65 years, care road	Korean version of MMSE 12 items Score 0-30 <24 interruptions cognitive	orientation in terms of time and space, memory, focus, word recall, computation, language, comprehension, and retrieval choice	Duration of long sleep and physically heavy weakness can increase impairment function in older people with AF and HF
19	(Sugie et al., 2018) Japan	To analyze the connection between function cognitive and cardiac parameters in the community with HFpEF Design: Cross-sectional	108 patients HFpEF, > 50 years, the level in the community	MoCA version Japan Clinicals can detect mild cognitive impairment Score 0-30 MoCA was selected Because it is more sensitive to detecting impaired cognitive light than MMSE.	Not mentioned	The stroke volume index at peak exercise is essential for cognitive function Possibilities related to the hypothesis of cascade vascular
20	(Vellone et al., 2020) Italy	To identify the global and dimensional cognitive impairments unique to heart failure (HF) and examine the sociodemographic factors linked to clinics that affect cognitive function in patients across multiple nations Design: RCT	605 patients with HF, care walking, age >18 years, NYHA I-IV, yes speak and understand language	MoCA Score 0-30 Worn worldwide, including patients with HF, for measuring cognitive 27-30, there is an impairment in cognitive, 18-26 light cognitive disorders, 10-17 breakdowns cognitive currently, <10 interruptions cognitive heavy	Visuospatial/executive, naming, attention, language, abstract, memory delayed, orientation	Cognitive impairment is related to HF problems with the memory domain Capacity exercise is a possible factor that can modify the potential for cognitive repair
21	(Yamamoto et al., 2022) Japan	To examine the frequency and predictive significance of cognitive decline in elderly individuals with heart failure Design: Prospective multicenter observational study	1215 patients with HF ≥65 years of age treated stay	Mini-Cog Combination of 3 memory items with drawing clock Score 5 (<3 abnormal)	Not mentioned	Weakness physical has a minor Mini-Cog score

Characteristics of Cognitive Function Screening Instruments and Their Domains

The Diagnostic and Statistical Manual of Mental Disorders (DSM) 5 categorizes cognitive function into multiple domains, namely executive function (decision-making), language, complex attention, motor perception, learning and memory, and social cognition, to diagnose major and minor neurocognitive disorders (Lovell et al., 2019). Cognitive function screening instruments that cover most domains of cognitive function include the Modified Telephone Interview for Cognitive Status (TICS-m), Hodkinson Abbreviated Mental Test (AMT), Mini-Cog, Modified Mini-Mental Status Examination (3MS), and MoCA. Other instruments only cover one to three domains. **Table 2** shows that all cognitive function screening instruments do not cover the social cognitive domain because they are intended for individuals. Two instruments cover six of the seven domains, namely 3MS and MoCA.

Sensitivity and Specificity

The MMSE has been extensively used worldwide to identify cognitive impairment since Folstein created it in 1975, making it a common point of comparison with later cognitive function instruments. The MMSE instrument has a sensitivity of 81% and specificity of 89% for detecting dementia compared to neuropsychological batteries. However, its sensitivity is low (62%), and specificity is high (87%) in identifying mild cognitive impairment (Tsoi et al., 2015). The AMT instrument can detect dementia in people aged 65 or older with a sensitivity of 91.5% and specificity of 82.4% (Sarasqueta et al., 2001). The AMT instrument is reliable and equivalent to the MMSE for scores <24 in detecting impaired cognitive function (Piotrowicz et al., 2019).

Compared to MMSE in individuals with less than 12 years of education, 3MS had a sensitivity of 0.94 and specificity of 0.95, while MMSE in individuals with 12 or more years of education had a sensitivity of 0.88. Additionally, 3MS had a sensitivity of 0.91 and a specificity of 0.95, higher than MMSE in dementia detection (McDowell, 2006). Sensitivity in mild cognitive impairment showed that 3MS was superior to MMSE (0.84 vs. 0.58), but specificity was similar between 3MS and MMSE (0.71 vs. 0.82) (Van Patten et al., 2019). The weakness of the 3MS and MMSE instruments is their low specificity in distinguishing dementia from mild cognitive impairment (McDowell, 2006).

The Mini-Cog had better sensitivity than MMSE (91% vs. 81%), while the specificity was similar between Mini-Cog and MMSE (86% vs. 89%) in detecting dementia (Tsoi et al., 2015). Mini-Cog also demonstrated better sensitivity (85.7% vs. 64.7%) and specificity (79.4% vs. 71.5%) than MMSE for screening mild cognitive impairment. Mini-Cog has the advantage of being less influenced by respondents' age, language, and level of education (Borson et al., 2005; Li et al., 2018).

The Telephone Interview for Cognitive Status (TICS) and Modified Telephone Interview for Cognitive Status (TICS-m), similar to MMSE, aid in distinguishing between normal and dementia. With 69.3% sensitivity and 68.6% specificity in TICS and 73.3% sensitivity and 67.1% specificity in TICS-m, both TICS and TICS-m outperformed MMSE in differentiating mild cognitive impairment from normal cognitive function (Seo et al., 2011). The TICS-m instrument alone had a cut-off score of 34 and below, with a sensitivity of 82.4% and specificity of 87.0% to identify mild cognitive impairment (Cook et al., 2009).

The MoCA, which showed excellent sensitivity in identifying Alzheimer's dementia disease and mild cognitive impairment at 90% and 100%, outperformed MMSE, which had poor sensitivity at 18% and 78%, respectively. MMSE demonstrated excellent specificity in accurately identifying 100% of cognitive normal. Additionally, MoCA demonstrated an exceptional 87% specificity for recognizing normal cognitive function (Nasreddine et al., 2005). However, MoCA had poor sensitivity (49%) and reasonable specificity (70%) in populations with low cognitive impairment (Holm et al., 2020).

Clinical Use of Cognitive Function Screening

The literature suggests that cognitive function screening in HF can serve as a tool to evaluate the outcome or impact of therapy/intervention (Gary et al., 2019; Redwine et al., 2020; Sugie et al., 2018; Vellone et al., 2020), monitor how HF affects cognitive function (Kuipers et al., 2022; Miao et al., 2023; Seo et al., 2023), and monitor HF prognosis (Aili et al., 2022; Holm et al., 2020; Huynh et al., 2021; Kim et al., 2019; Kuhn et al., 2022; Rigueira et al., 2021; Seo et al., 2024; Yamamoto et al., 2022).

Discussion

The search results for the cognitive function screening instruments in this scoping review indicate that no instruments were explicitly designed for patients with HF. All available cognitive function screening instruments serve global purposes. Additionally, not all available instruments cover the cognitive domains necessary for screening cognitive function in patients with HF, namely attention/concentration, executive function, language, and visuospatial/construction abilities (Lovell et al., 2019).

One cognitive function screening instrument containing executive function domains associated with HF is the MoCA. The MoCA instrument has been widely utilized in various studies to measure the cognitive function of patients with HF, particularly in the last five years. This study identified 11 articles that used MoCA as a cognitive screening instrument. The advantage of this instrument is its high sensitivity in measuring mild cognitive impairment compared to other instruments, with specificity equivalent to that of the MMSE. However, its disadvantages include being a face-to-face interview and consuming a considerable amount of time (10 minutes), thus occupying respondents' time and limiting its use for many respondents within a short period. Additionally, language influences this instrument, requiring validity and reliability for each language (Tsoi et al., 2015).

Another instrument suitable for rapid screening is the Mini-Cog. This instrument can be administered quickly (< 5 minutes) and exhibits good sensitivity (99%) for detecting dementia (Ampadu & Morley, 2015). However, it lacks coverage of the attention/concentration and language domains necessary for HF (Lovell et al., 2019) and is less effective in detecting mild cognitive impairment (Ampadu & Morley, 2015).

Table 2 Cognitive function screening instruments, data collection method, scoring system, estimated time to complete, sensitivity and specificity of measuring severe cognitive impairment (dementia), and cognitive domain according to DSM-5

Name	Method	Scoring	Time	Sensitivity	Specificity	Domain of Cognitive Function according to DSM-5 (del Barrio, 2004)					
						Attention	Executive function	Learn & Memory	Language	Motor perceptual	Social cognitive
Hodkinson Abbreviated Mental Test (AMT)	Face-to-face interview [26 questions (Hodkinson, 1972)]	Maximum score 33; score ≤6 suspected of dementia (Huijts et al., 2013)	3-4 minutes (Villarejo & Puertas-Martín, 2011)	91% (Sarasqueta et al., 2001)	82%	√	-	√	-	√	-
Mini-Mental State Examination (MMSE)	Face-to-face interview [11 questions (Folstein et al., 1975)]	Cognitive impairment ranges from 0 to 23, mild from 24 to 27, and normal from 28 to 30 (Seo et al., 2024)	5-10 minutes (Folstein et al., 1975)	81% (Tsoi et al., 2015)	89%	√	-	√	-	√	-
Modified Mini-Mental Status Examination (3MS)	Face-to-face interview [15 questions (Teng & Chui, 1987)]	Maximum score 100; mild cognitive impairment if score <95 (Van Patten et al., 2019)	10-15 minutes (Teng & Chui, 1987)	94% for education <12 years 91% for education ≥12 years (Van Patten et al., 2019)	95% for education <12 years 95% for education ≥12 years	√	√	√	√	√	-
Mini-Cog	Face-to-face interview repeats three words and draws a clock (Borson et al., 2000)	Maximum score 3, and cognitive impairment is indicated by a score of less than 2 (Borson et al., 2003)	2-4 minutes (Borson et al., 2003)	91% (Tsoi et al., 2015)	86%	-	√	√	-	√	-
Modified Telephone Interview for Cognitive Status (TICS-m)	The telephone interview [13 questions (Brandt et al., 1988)]	Scores less than 23 indicate cognitive impairment, with a maximum score of 39 (Bentvelzen & Kochan, 2020)	3 minutes (Prince et al., 1999)	88% (Seo et al., 2011)	90%	√	-	√	√	√	-
Montreal Cognitive Assessment (MoCA)	Face-to-face interview [8 questions (Nasreddine et al., 2005)]	26–30 normal; 18–25 mildly impaired; 10–17 moderate; <10 severe. Education <12 years plus 1 score (Vellone et al., 2020)	10 minutes (Husein et al., 2010)	90% (Nasreddine et al., 2005)	87%	√	√	√	√	√	-

The TICS-m instrument offers the benefit of widespread use through telephone administration, completing the screening rapidly (<5 minutes) without requiring face-to-face interaction with respondents, and slightly improved sensitivity in detecting mild cognitive impairment compared to MMSE (Seo et al., 2011). However, it does not cover the visuospatial and executive function domains crucial for HF.

Which screening instrument is best for HF? A comparison between instruments based on data collection methods, required time, and number of cognitive function subdomains associated with HF is presented in **Table 2**. Considering the number of cognitive function domains covered by screening instruments, the available options include 3MS and MoCA. While 3MS offers reasonable specificity and sensitivity for identifying cognitive impairment, its drawback lies in its lengthy administration time, ranging from 10-15 minutes (Teng & Chui, 1987; Van Patten et al., 2019), as opposed to MoCA, which takes around 10 minutes (Nasreddine et al., 2005).

Considering the speed of screening procedures, the fastest instrument is Mini-Cog, followed by TICS-m and AMT (Borson et al., 2003; Prince et al., 1999; Villarejo & Puertas-Martín, 2011). However, they do not cover all crucial subdomains relevant to HF. Regarding the data collection method, TICS-m stands out as it can be widely used without face-to-face interaction. Nonetheless, it lacks coverage of visuospatial subdomains and executive functions vital for HF (Seo et al., 2011).

The authors consider MoCA to be the instrument covering all cognitive function domains affecting HF, with a relatively short examination time. This instrument is susceptible to mild cognitive impairment compared to other screening instruments (Tsoi et al., 2015). Moreover, the MoCA instrument is validated and reliable, with a kappa coefficient of 0.82 and Cronbach's alpha of 0.75 (Husein et al., 2010). However, its weaknesses include the challenge of detecting cognitive impairment in a single domain among patients with HF. Additionally, 30% of patients with HF declared free from cognitive impairment may still experience cognitive impairment, necessitating further monitoring and evaluation through subsequent screening examinations (Hawkins et al., 2014).

Implications

This study suggests several implications for nursing practice in assessing cognitive function in patients with HF. Nurses should be knowledgeable about available cognitive screening tools and their limitations to choose the most suitable one for assessment, and they can use our study's findings for reference. Integrating cognitive screening into routine practice, especially during initial and follow-up assessments, is crucial. Nurses are vital in administering screenings, interpreting results, and initiating interventions. Collaboration with other healthcare professionals is essential for comprehensive evaluation and management. Nurses should educate patients and caregivers about the importance of cognitive health and its impact on HF management. Longitudinal monitoring of cognitive function is vital, as impairment may progress. Regular assessments can facilitate early detection and intervention, improving patient outcomes. Incorporating cognitive screening into nursing practice can enhance care quality and patient outcomes in HF management.

Limitations

Firstly, the selection of databases may not include all relevant articles related to the study topic. Consequently, the articles retrieved from the selected databases might not represent the entirety of available literature, potentially introducing bias. Additionally, not all articles identified during the database search may be accessible or published in full text, possibly contributing to bias in the study results.

Conclusion

This scoping review highlights the necessity for cognitive function screening instruments specifically for patients with HF. While existing tools like MoCA, Mini-Cog, and TICS-m show promise for HF cognitive assessment, each has strengths and weaknesses. MoCA stands out as a prominent tool, offering comprehensive coverage of cognitive domains despite challenges in time consumption and language barriers. Further research is crucial to explore additional screening tools explicitly designed for patients with HF and address existing instrument limitations. Nurses and healthcare professionals need to integrate these tools into routine practices for managing patients with HF, emphasizing the need for ongoing research into their utilization.

Declaration of Conflicting Interest

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Authors' Contributions

All authors contributed equally to this study, except for searching the articles in the databases, which was only done by the first author (Arsuti Arseda).

Authors' Biographies

Astuti Arseda, S.Kep., Ners is a student in the Master of Nursing Program, Faculty of Nursing, Universitas Padjadjaran, Indonesia.
Tuti Pahria, S.Kp., M.Kes., PhD is a Lecturer in Medical-Surgical Nursing, Faculty of Nursing, Universitas Padjadjaran, Indonesia.
Titis Kurniawan, S.Kep., Ners., MNS is a Lecturer in Medical-Surgical Nursing, Faculty of Nursing, Universitas Padjadjaran, Indonesia.

Data Availability

All data generated or analyzed in this study are included in this published article (and its supplementary information file).

Declaration of Use of AI in Scientific Writing

There is nothing to declare.

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