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Detecting Cognitive Impairment and Dementia in the Emergency Department: A Scoping Review

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Abstract

Objectives: To identify research and practice gaps to establish future research priorities to advance the detection of cognitive impairment and dementia in the emergency department (ED).

Design: Literature review and consensus-based rankings by a transdisciplinary, stakeholder task force of experts, persons living with dementia, and care partners.

Setting and Participants: Scoping reviews focused on adult ED patients.

Methods: Two systematic scoping reviews of 7 medical research databases focusing on best tools and approaches for detecting cognitive impairment and dementia in the ED in terms of (1) *most accurate* and (2) *most pragmatic* to implement. The results were screened, reviewed, and abstracted for relevant information and presented at the stakeholder consensus conference for discussion and ranked prioritization.

Results: We identified a total of 1464 publications and included 45 to review for accurate tools and approaches for detecting cognitive impairment and dementia. Twenty-seven different assessments and instruments have been studied in the ED setting to evaluate cognitive impairment and dementia, with many focusing on sensitivity and specificity of instruments to screen for cognitive impairment. For pragmatic tools, we identified a total of 2166 publications and included 66 in the review. Most extensively studied tools included the Ottawa 3DY and Six-Item Screener (SIS). The SIS was the shortest to administer (1 minute). Instruments with the highest negative predictive value were the SIS (vs MMSE) and the 4 A's Test (vs expert diagnosis). The GEAR 2.0 Advancing Dementia Care Consensus conference ranked research priorities that included the need for more approaches to recognize more effectively and efficiently persons who may be at risk for cognitive impairment and dementia, while balancing the importance of equitable screening, purpose, and consequences of differentiating various forms of cognitive impairment.

Conclusions and Implications: The scoping review and consensus process identified gaps in clinical care that should be prioritized for research efforts to detect cognitive impairment and dementia in the ED setting. These gaps will be addressed as future GEAR 2.0 research funding priorities.

Keywords

Dementia; emergency department; cognitive impairment

Emergency care of older people with cognitive impairment and persons living with dementia (PLWD) is suboptimal despite rates of emergency department (ED) use up to 50% greater than those without dementia.[1,2] In fact, PLWD are poorly identified in the ED,[3,4] are 1.5 times more likely to have an avoidable ED visit,[2] and are twice as likely to be admitted to the hospital or return after an ED visit.[5] Remarkably, it has been suggested that more than a quarter of older adults who visit the ED have some form of impaired mental status, and yet 62% of those individuals have no prior history of cognitive impairment documented in their medical record.[6]

The Geriatric Emergency care Applied Research 2.0 Networke–Advancing Dementia Care (GEAR 2.0 ADC), a National Institute of Aging (NIA)–efunded effort, was created to

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support research to fill these gaps in emergency care for PLWD and their care partners. Detection of those in the ED with cognitive impairment or dementia was prioritized as one of the 4 critical domains for further investigation by stakeholders and task force members of the GEAR 2.0 Network. GEAR identifies research gaps and proposes research priorities for the detection of cognitive impairment and dementia in the ED with a scoping review process and a stakeholder consensus approach. The goal is to support research focused on these priorities, thus generating evidence to inform and advance better patient care. This article details the scoping review process, its results, and the research priorities of the subsequent GEAR 2.0 ADC Consensus Conference.

Methods

The GEAR 2.0 ADC task force was recruited from a pool of cognitive impairment, dementia, geriatrics, and emergency medicine experts identified through prior collaborations, geriatric emergency medicine focus groups, and partner organizations. The workgroup included ED-based and non-ED-based clinicians, individuals living with dementia, care partners, and advocacy organizations. GEAR 2.0 ADC members were selected based on membership in national geriatric emergency medicine interest groups and through relevant publications in the GEAR 2.0 ADC domains. The task force members were assigned to one of 4 workgroups representing research and practice priority domains: ED Care Practices, ED Care Transitions, Communication and Decision Making, and Detection and Identification (Detection). A list of task force members can be found in the Acknowledgments section.

The GEAR 2.0 Detection workgroup consisted of 20 individuals: 6 emergency medicine physicians, 2 neuropsychologists, 2 geriatricians, 2 staff researchers, 1 geriatric psychiatrist, 1 preventive medicine physician, 1 librarian, 1 social worker, 1 nurse practitioner, 1 biostatistician, 1 PLWD, and 1 care partner. The workgroup, over the course of 6 months, convened videoconference meetings to discuss the scoping review aims, propose the research questions, review the search criteria, and examine the scoping review results, and abstraction of final papers.[7]

The Detection workgroup conducted a scoping review adhering to the Preferred Reporting Items for Systematic Review and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) reporting guidelines[8] used by all 4 workgroups. The Detection workgroup developed key priority questions that were voted on by the entire GEAR 2.0 task force. The top 2 questions were converted to the Population, Intervention, Comparison, and Outcome (PICO) format to guide the systematic scoping reviews.[9] The GEAR 2.0 Detection workgroup focused on the best tools and approaches for detecting cognitive impairment and dementia in the ED in terms of *most accurate* (PICO 1) and *most pragmatic* (PICO 2) outcomes.

The scoping review is registered on Open Science Framework (see Box 1).[10]

Search Strategy

Published literature was searched using strategies developed by the 4 participating medical librarians. They established common search terms and key words across the workgroups.

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The medical librarian (AB) used the Detection workgroup PICO questions and their corresponding exemplar articles to guide, refine, and develop search strings specific to the domain of cognitive impairment. PICO 1 focused on measures of diagnostic accuracy including sensitivity and specificity, models, and reproducibility of results to detect and assess cognitive impairment and dementias. PICO 2 focused on the approach, practicality, and usability of the assessment as part of emergency clinical care. We searched Ovid Medline, Embase, CINAHL, CENTRAL, APA PsycINFO, Web of Science, and PubMed Central (see Supplementary Material 1) We deduplicated in 2 sequential automated steps: first, a deduplication system developed at the Cushing/Whitney Medical Library at Yale University was used. The remaining articles were then uploaded to Covidence (Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia), a web-based article review screening and extraction tool for scoping reviews. One additional deduplication step was performed through Covidence. Full search strategies are provided in the supplement.

Study Selection and Abstraction

The scoping review literature search was completed in May 2021. Two independent reviewers (U.H., A.N.) screened titles and abstracts for inclusion and exclusion criteria. Inclusion criteria for PICO 1 and PICO 2 were studies of assessments or tools that assessed for cognitive function focusing on dementia and occurred in the ED setting. Exclusion criteria for both PICO questions were studies that took place in children, did not include patients greater than 65 years in age, exclusively focused on delirium, or exclusively focused on traumatic brain injury. Articles that did not explicitly mention patients with cognitive impairment were retained in the full-text review if they met all other inclusion criteria. Additionally, systematic reviews pertinent to our objectives were kept and their reference lists were examined for relevance to the PICOs. Studies were retained if they met inclusion criteria and were not already identified in the initial search. The full texts of the articles that met these criteria were then reviewed. In cases of disagreement between the reviewers adjudication occurred via consensus between the 2 reviewers, or by a third workgroup member (C.C.).

Three authors (J.D., W.H., A.N.) abstracted the following data from the final articles based on a template that included standardized elements across the 4 workgroups such as study setting, participant demographics, race or ethnicity, and inclusion or exclusion criteria, among other information.

The PICO 1 abstractions included the screening instrument or tool studied, the gold standard used for dementia or cognitive impairment, and measures of accuracy, reliability, sensitivity, specificity, likelihood ratios, correlation coefficients, etc. For PICO 2, objective measures of feasibility, pragmatic nature, timing, or efficiency of a tool were abstracted. If no objective measures were reported, then authors' remarks on a tool's feasibility were abstracted. These included ease of use, speed, setting, integration into routine care, the outcome effect and size, feasibility, acceptability, safety, and other measures of success or failure of the interventions.

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Research and Practice Gap Assessment

The results of the scoping reviews, including the abstraction tables and publications, were discussed by the Detection workgroup. The group also discussed how to present the available research and practice gaps to the GEAR 2.0 ADC Consensus Conference.

The scoping review results were presented at the GEAR 2.0 ADC Consensus Conference meeting from September 10 to 11, 2021. The goal of the meeting was to have stakeholders analyze the current evidence and identify the research and practice gaps for future research. Members discussed and voted on the research priorities in the detection of cognitive impairment in the ED. To effectively discuss the topic, participants were split into 4 groups. The groups then reconvened and discussed the perceived research and practice gaps needing attention. This discussion was then synthesized by the Detection workgroup to form the final research priorities. All Consensus Conference attendees voted to prioritize the research and practice gaps to provide guidance for future GEAR 2.0 pilot funding opportunities. Those absent from the conference were asked to vote asynchronously, for 100% participation by all 4 workgroups and Health Equity Advisory Board members.

Results

Abstraction Process

We identified 1464 citations for PICO 1; we removed 1271 citations as they did not meet inclusion criteria. The interrater reliability between both screeners was modest ($\kappa = 0.67$). Ninety-three underwent full-text review, from which an additional 50 were excluded (19 had no measures of diagnostic accuracy, 15 were not in the ED, 5 did not detect dementia, 5 were duplicates, 3 were abstracts of existing full papers, 1 focused only on traumatic brain injury, 1 focused only on delirium, 1 was a letter to the editor), leaving a total of 43 manuscripts for PICO 1 abstractions. Two additional manuscripts were identified from references listed in the abstracted manuscripts bringing the total number of manuscripts to 45. See Supplementary Figure 1, PRISMA-ScR flow diagram PICO 1.

We identified 2166 citations for PICO 2; we removed 2030 as they did not meet inclusion criteria. The interrater reliability between both screeners was low ($\kappa = 0.37$). One hundred thirty-six underwent full-text review, from which an additional 70 were excluded (33 had no measure or mention of feasibility or pragmatic nature, 25 were not in the ED, 5 did not detect dementia, 3 were abstracts of full-text papers, 3 were duplicates, 1 was not available in English), leaving 66 papers for PICO 2 abstractions. During the abstraction process, 1 manuscript was removed as it was a duplicate and 1 additional manuscript was identified by reference review. See Supplementary Figure 2, PRISMA-ScR flow diagram PICO 2.

There were 21 articles that were included in both PICO 1 and PICO 2 literature abstractions. See supplement for full abstraction tables (Supplementary Tables 1 and 2).

Abstraction Results

PICO 1—Of the 45 manuscripts, 9 only had abstracts with 3 from the same study, and 5 were review papers or editorials. Patient race or ethnicity or language spoken were reported

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33% and 31% of the time in abstracted manuscripts, respectively. All those reported were English-speaking except for 2 studies that enrolled French-speaking patients. No manuscript captured sexual orientation or religious faith of the participants. Age for inclusion varied, ranging from >18 years to >75 years. The majority of manuscripts included people aged ≥65 years. The number of studies and age criteria were as follows: ≥18 years (1), ≥45 years (1), ≥55 years (1), ≥60 years (1) ≥65 years (24), ≥70 years (4), and ≥75 years (7).

Twenty-seven different assessments or instruments were evaluated or mentioned in the 45 abstracted manuscripts for PICO 1 (Table 1). The Mini-Mental Status Exam (MMSE) was the most commonly used measure as the gold standard in 23 of these 45 studies. Other measures that were used were the modified Telephone Interview for Cognitive Status–modified (TICS-m); the Montreal Cognitive Assessment (MoCA); the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE); previously documented history; patient or kin report; the Orientation, Memory, Concentration Test (OMCT); the Eight-item Interview to Differentiate Aging and Dementia (AD8); the Short Blessed Test (SBT); Bergman-Paris Question; Brief Risk Identification for Geriatric Health Tool (BRIGHT); and the ED Mini-Cog in declining order of use. Table 1 includes citations from PICO 1 and PICO 2 (see below) and is titled PICO 1 and PICO 2 ED Cognitive Impairment Assessment Instruments Evaluated For Diagnostic Accuracy and Time to Complete.

PICO 2—Of the 66 manuscripts abstracted, 5 were not in English but had English abstracts, 4 reported on race or ethnicity, and 5 reported on language. None reported sexual orientation or religious faith, and 20 reported measures of feasibility.

Studies evaluating feasibility focused on (1) the length of time needed to administer the assessments and (2) barriers and acceptability of screens. Time was the most commonly studied measure of feasibility. The time needed to complete an assessment was a concern of clinicians, with an ideal time of <5 minutes reported in the survey by Zun et al[40] administered to emergency physicians. Kennelly et al[41] reported that 29% of emergency physicians reported lacking the expertise to screen for cognitive impairment and dementia. A study of emergency physicians and nurses[19] reported that more than 95% of them found the Ottawa 3DY screening tool to be easy to learn and use in the clinical setting. Acceptance of different screen tools or screening methods by patients and ED staff was assessed in 3 manuscripts. Boucher et al[42] assessed the acceptance of completing screening tools on a tablet computer compared to paper or orally with a research assistant by older patients in the ED. They found that patients aged <85 years were accepting of tablets whereas those older were less accepting. The Clock Draw Test was easily accepted by patients and family members in the emergency setting.[43] Carpenter et al[4] found ED clinicians accepting of geriatric technicians screening patients for cognitive issues. Table 1 presents PICO 2 findings on the length of time different assessment methods take to complete.

PICO 1 and PICO 2—Twenty-one articles overlapped in the PICO 1 and 2 searches. Key papers to highlight are 2 recent systematic reviews of ED cognitive impairment assessment instruments. Calf et al[44] identified the O3DY as having the highest pooled sensitivity of 0.90 (95% CI 0.71–0.97), and the Six-item Screener (SIS) had the highest pooled specificity of 0.79 (95% CI 0.75–0.83). These findings were similar to another meta-analysis of

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ED dementia screening instruments by Carpenter et al.[45] The most commonly used gold standard evaluation was the MMSE, used in 10 of these papers.

The SIS was found to take a median of 1 minute to administer to patients in Alzheimer's clinic and have 94% and 86% sensitivity and specificity, respectively, and a negative predictive value of 98% and a positive predictive value of 68%. The area under the ROC curve for the SIS was 0.96.[11]

Table 1 includes studies from PICO 1 and PICO 2 that reported diagnostic accuracy measures with time to complete each assessment where available. With regard to the practicality of administering these assessments in the ED environment, Hirschman et al[46] found the SIS and the clock-draw test had no association with time of day, total patient hours, being screening in a private room, and number of people in the waiting room (crowding).

Many of these instruments are publicly available on the Geriatric Research Instrument Library (https://www.peppercenter.org/public/gril.cfm) under the Cognitive/Dementia Domain Category.[47]

Consensus Conference Ranked Priorities—Ranked research priorities focused on (1) best approach in the ED with regards to screening for cognitive impairment, (2) the joint evaluation of accuracy and feasibility, (3) consideration of the impact of screening of cognitive impairment in the ED, (4) consideration of patient characteristics and the settings and populations serviced, and (5) differentiating dementia from other conditions that may impair cognition (eg, delirium, mental health conditions). The list of research priorities, ranked by all members and those by clinicians vs PLWD and care partners, are presented in Table 2.

Discussion

Over the last 2 decades, there have been multiple studies evaluating ED detection of cognitive impairment specifically focused on dementia. Our scoping review identified more than 45 manuscripts addressing accuracy of detection of cognitive impairment or dementia, 66 addressing pragmatic and practical ways for this detection, and 21 manuscripts overlapping in both. Most commonly studied instruments found to have high sensitivity and negative predictive value included the SIS,[11] O3DY,[18,20,21] and 4AT[28,32] and could be considered for use in clinical care. These instruments also take a short time to administer, ranging from <1 minute for the SIS,[11] <2 minutes for the O3DY,[35] to <3 minutes for 4AT.[37]

Although these limited data support their use to screen for dementia in the ED, there was consensus that the findings were heterogeneous and more evidence was needed to inform best practices. The GEAR 2.0 task force determined that although it is widely accepted that detection of cognitive impairment in the ED is beneficial and critical to providing good care, to accomplish this efficiently and effectively remains an undermet need. Many of these tools have existed for decades, but continue not to be implemented into practice. Research is needed to address concerns about feasibility, demonstrate their applicability, and find ways to increase their integration into clinical care. Determining the best approach in the ED

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for screening cognitive impairment was the top research priority from this transdisciplinary group of stakeholders that also included PLWD and their care partners. The approaches should encompass pragmatic screening processes, interventions that include referral for subsequent evaluation, and even use of patient and population risk factors or electronic health record data to improve detection of cognitive impairment and dementia in the ED setting. Such evidence could change and improve practice.

The need for more research to develop accurate *and feasible* tools to identify cognitive impairment in the absence of delirium or known dementia was the next priority focus ranked by the GEAR 2.0 Consensus Conference. In the ED setting, when patients often present with changes in cognition, it is important to determine if the impairment is new and originates from a treatable medical condition such as delirium, or from a slower decline in cognition in the setting of chronic cognitive impairment (dementia) not previously recognized. Delirium is a medical emergency and requires prompt assessment and treatment.[48] Dementia is a risk factor for delirium, and not recognizing it can impact clinical decision making, patient care transitions, and safety. Developing instruments to differentiate the two are critical for the ED setting. The importance of understanding what information is needed to differentiate delirium vs undiagnosed cognitive impairment vs known dementia and other mental health etiologies was thus another important research priority ranked by the GEAR 2.0 task force.

The next Detection research priority ranked by the Consensus Conference focused on understanding the value and potential unintended consequences of screening for cognitive impairment in the ED. Priorities expressed by PLWD on the task force emphasized the importance of clear communication of purpose, potential risks, benefits, and value of cognitive screening. Efforts in the ED should be made to ensure the patient and care partners have an understanding of the screening results and potential follow-up steps.[49] Older adults may consider screening to be strenuous or stressful, which may be due to a perceived pressure to perform well on the test.[50] There may be misunderstandings around both the reasons for a screen and the implications of test results. Therefore, clear communication should be made that the screening does not constitute diagnosis, but rather may lead to additional evaluation and management after the ED visit by appropriate clinicians. Moreover, consideration to whether a care partner is to be informed and involved in the decision making is also important. The individual being screened may have preferences about whether they would want to know if cognitive impairment is present and if the results should be communicated to care partners and to whom.[51,52]

Another research priority ranked by the task force was how to account for culture, language, the ED environment, and communities of the population served when screening for cognitive impairment in the ED. Although the scoping review searches identified 101 articles, most of these articles focused on the detection of dementia or cognitive impairment in limited languages, most in English, some in French, and 1 in Spanish. Some studies even excluded patients if they were non-English speaking. The GEAR 2.0 Consensus Conference emphasized the importance of cognitive impairment detection to define the characteristics of patients that present to the ED, including aspects like language, ethnicity, and social determinants of health that may predispose patients to inequitable differences in health and medical care.

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Finally, the GEAR 2.0 Consensus Conference emphasized that the ED's role is not to assign a definitive diagnosis of dementia. It is important to acknowledge the US Preventative Services Task Force statement that there is no trial evidence to support screening older adults for cognitive impairment. They also state that early diagnosis of cognitive impairment does not improve patient, caregiver, family, clinician decision making, or other important outcomes, nor does it cause harm.[53] For the GEAR 2.0 Consensus Conference, however, the presence of an older person in the ED with signs, symptoms, or complaints of cognitive change does, in fact, warrant evaluation to ensure appropriate care in the ED and referral at discharge. A review of practice guidelines for dementia detection indicates that cognitive evaluation should occur "when a caregiver" such as a family member, friend, or other informant describes cognitive decline.[54] The 3 most common aspects of the evaluation that are the minimum requirement for diagnosis are (1) cognitive assessment with a standardized tool, (2) evaluation of comorbid conditions with medication review and laboratory tests, and (3) a history and physical examination. All steps are required, although they may be difficult to achieve in the ED setting.

Conclusion and Implications

We report the results of 2 systematic scoping reviews evaluating diagnostic accuracy and feasibility to detect cognitive impairment and dementia in the ED setting. The GEAR 2.0 Advancing Dementia Care task force, using these results, developed consensus research priorities practice gaps to advance the detection of cognitive impairment and dementia in the ED setting. They include the need for more effective and efficient approaches to recognize persons at risk for cognitive impairment and dementia. These approaches should balance the importance of equitable screening and the goal and the consequences identifying cognitive impairment. These research priorities will be the basis of future GEAR 2.0 research funding opportunities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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PICO Questions

The GEAR 2.0 ADC Detection workgroup generated the following PICO questions:

Detection PICO-1:

How can the ED best identify cognitive impairment? (Best in terms of sensitivity, reliability, practicality, ease, and speed of completion, etc.) Are there differences by race or ethnicity?

Population: All ED patients (no children, no studies that excluded patients older than 65).

Intervention: ANY assessment available during the ED visit to identify cognitive impairment, cognitive frailty, or confusion.

Comparison: Gold/Reference standard assessments.

Outcomes:

Measures of diagnostic accuracy including sensitivity, specificity, likelihood ratios, etc. against gold standards.

Detection PICO-2:

Are there pragmatic cognitive impairment screening tools that can identify patients at risk of dementia? (Pragmatic in terms of ease of use, training, quickness to complete, etc.)

Population: All ED patients (no children, no studies that excluded patients older than 65).

Intervention: ANY assessment available during the ED visit to identify cognitive impairment, cognitive frailty, or confusion.

Comparison: Gold/Reference standard assessments.

Outcomes: Time on task for assessment, clinician acceptability of assessment, training time for assessment, completion rates of assessment, patient harms from assessment.

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Table 1

PICO 1 and PICO 2 ED Cognitive Impairment Assessment Instruments Evaluated for Diagnostic Accuracy and Time to Complete

Gold Standard	Gold Standard Cutoff Score	Comparison	Sensitivity, %	Specificity, %	PPV, %	NPV, %	PLR	NLR	AUC	Time to Complete, min	Other Measures	Reference
MMSE	<24	Six-Item Screener	94	86	68	98				<1		Wilber[11]*
	<24	Six-Item Screener	63	81	60	83			0.77			Wilber[12]*
	<24	Six-Item Screener	74	77			3.3	0.33	0.83			Carpenter[3]*
	<24	Mini-Cog	75	85	57	93				1.5		Wilber[11,]*
		Quick Confusion Scale								2.35	Correlation: $r = 0.783$	Huff[13,]*
	<24	Quick Confusion Scale	64	85							Correlation: $r = 0.61$	Stair[14,]*
	<24	AMT10	Score 8: 92	75	74	92						Schofield[15]
	<24	AMT4	Score 3: 80	88	84	85						
	<25	Ottawa 3DY–English	Nurses 90.1	60								Eagles[16,]*
			Physicians 72.7	50								
	<24	Ottawa 3DY–English	71.4	56.3								Barbic[17]
	<25	Ottawa 3DY–English	93.8	72.8			3.5	0.08				Wilding[18,]*
	<25	Ottawa 3DY–English	Nurses 84.6	54								Eagles[19,]*
			Physicians 78.9	70								
	<24	Ottawa 3DY–English	95	51			2	0.1				Carpenter[20,21,]*
	<25	Short Blessed Test	85.7	58.3								Barbic[17]
	<24	Short Blessed Test	95	68			2.7	0.08	0.89			Carpenter[20,21,]*
	<25	Animal Fluency Test	90.6	39.3			1.5	0.24				Wilding[18,]*
	<24	Patient AD8	37	82			2	0.77	0.67			Carpenter[3,]*
	<24	Caregiver AD8	66	67			2.2	0.27	0.825			Carpenter[20,21,]*
	<24	Caregiver AD8	63	79			3	0.44	0.74			Carpenter[3,]*
	<24	Brief Alzheimer's Screen	100	53					0.945			Carpenter[20]

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Gold Standard	Gold Standard Cutoff Score	Comparison	Sensitivity, %	Specificity, %	PPV, %	NPV, %	PLR	NLR	AUC	Time to Complete, min	Other Measures	Reference
	<24	Physical Assessment									Handgrip strength, 0.67; TNF, −0.34; IL-6, −0.36; visfatin, −0.01	Huang[22]
	<24	Documentation in notes									Percentage of undocumented cognitive impairment in patients with abnormal MMSE score in past medical history, ED physician note, inpatient physician note, and emergency nurse note: PMH: 86%, emergency physician: 72%, emergency nurse: 84%, inpatient physician: 60%	Heidt[23]
	<24	Physician's Assessment									% agreement: 67%	Dziedzic[24,*]
	N/A	Serious Game									Correlation of game response time, −0.558; and accuracy, −0.104 (nonsignificant) with MMSE score	Tong[25]
MoCA	<26	Caregiver AD8	54	78			2.4	0.59				Turner[26]
	<26	Short Blessed Test	47	89			4.1	0.6				Turner[26]
	<26	Brief Alzheimer's Screen	61	83			3.6	0.47				Turner[26]
	N/A	Serious Game									Correlation of game response time, −0.339; and accuracy, −0.042 (nonsignificant) with MoCA score	Tong[25]
CAM		Ottawa 3DY–French	Delirium detection 85	57.7								Bedard[27]
		4 A's Test (4-AT)	84	74	19	98						Gagne[28]
TICS-m	<27	4 A's Test (4-AT)	49	87	48	88						Gagne[28]
	<27	Ottawa 3DY–French	Delirium detection 84.2	60			2.0	0.3				Bedard[29]

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Gold Standard	Gold Standard Cutoff Score	Comparison	Sensitivity, %	Specificity, %	PPV, %	NPV, %	PLR	NLR	AUC	Time to Complete, min	Other Measures	Reference
	<27	Ottawa 3DY–French	Cognitive impairment 76.7	70								Bedard[27]
	<27	Ottawa 3DY–French	Cognitive impairment 76.2	70			2.4	0.4				Bedard[29]
	<27	Bergman-Paris Question	86.5	30	30	90						Lague[30,*]
Combined CAM-ICU, AD8, sMMSE	Positive screen on any tests	AMT4	53.0	96	94.6	73.3	14.7	0.5	0.75			Dyer[31]
Expert diagnosis[†]	N/A	4AT[‡]	84	63	39	94			0.83			O'Sullivan[32]
		6-CIT[‡]	81	76	46	94						
		APOP								1.5		Blomaard[33]
		Caregiver AD8								<6		Dyer[55]
		OMC								~2		Gerson[34]
		MoCA								~10		Han[35]
		Ottawa 3DY–English								<2		
		Short Blessed Test								<5		
		6-CIT								2–3		Lucke[36]
		4AT								2.6		Myrstad[37]
		Emergency Geriatric Screen								<5		Schoenengerger[38]
		Short-term memory recall test								2–5		Yamamoto[39]

4AT, 4 A's Test; AD8, Ascertain Dementia 8; AMT, Abbreviated Mental Test; APOP, acutely presenting older patient; AUC, area under the curve; CAM, Confusion Assessment Method; CAM-ICU, Confusion Assessment MethodeIntensive Care Unit; IL-6, interleukin 6; MoCA, Montreal Cognitive Assessment; MMSE, Mini-Mental State Examination; N/A, not applicable; NLR, negative likelihood ratio; NPV, negative predictive value; PLR, positive likelihood ratio; OMC, Orientation-Memory-Concentration; PMH, past medical history; PPV, positive predictive value; 6-CIT, Six-Item Cognitive Impairment Test; TICS-m, Telephone Interview for Cognitive Statusemodified; TNF, tumor necrosis factor.

[*]Article included for PICO 1 and PICO 2.

[†]Expert (geriatrician with special interest in delirium/dementia) delirium and dementia diagnosis using *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-V*) criteria, using researcher-collected Standardized Mini Mental State Examination (sMMSE), Delirium Rating ScaleeRevised 98 (DRS-R98), Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) data, and demographic data, presenting complaint, and information from the general physician referral letter or hospital notes about dementia diagnosis.

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‡Multiple cutoffs were reported and diagnostic accuracy was measured. Only 1 cutoff is presented.

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Table 2

Consensus Conference Ranking of Detection and Identification Question Priority Comparing ED Providers, Non-ED Providers, and PLWD/Care Partners

Detection and Identification Research Priorities	Rankings			
	All Participants	ED Providers	Non-ED Providers	PLWD and Care Partners
What is the best approach* in the ED to screening cognitive impairment? (*Includes population definitions, using data sources, screening tests effectiveness, efficacy, referral, etc)	1st	1st	1st	1st
What are the most accurate and feasible tools and data to identify cognitive impairment in the absence of delirium or known dementia?	2nd	2nd	2nd	2nd
What is the value and potential unintended consequences of screening for cognitive impairment in the ED?	3rd	3rd	4th	3rd
How can EDs feasibly take into account culture, language, ED environment, and communities of the population served when screening cognitive impairment in the ED? (eg, does English as a second language impact screening of dementia?)	4th	4th	3rd	4th
What information is needed to differentiate delirium vs undiagnosed cognitive impairment vs known dementia vs mental health conditions?	5th	5th	5th	5th