MĄKA, Magdalena, SIKORA, Dominik, OLEKSY, Piotr, ZAJĄC, Adam, ZIELIŃSKI, Karol, PAPIEŻ, Łukasz, GÓRALCZYK, Ewa, KAMIŃSKI, Jakub, BUCZKOWSKI, Bartosz and WOCHNIK, Dagmara. Two Approaches to Cognitive Evaluation: Assessing the Strengths and Limitations of GPCOG and ACE-III. Journal of Education, Health and Sport. 2025;78:57572. eISSN 2391-8306.
https://doi.org/10.12775/JEHS.2025.78.57572
https://apcz.umk.pl/JEHS/article/view/57572

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).
The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 06.01.2025. Revised: 07.02.2025. Accepted: 07.02.2025. Published: 10.02.2025.

Two Approaches to Cognitive Evaluation: Assessing the Strengths and Limitations of GPCOG and ACE-III

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Abstract

Introduction : The aging population highlights age as a key risk factor for dementia and other cognitive disorders. Reliable diagnostic tools are crucial. This review examines the Addenbrooke's Cognitive Examination-III (ACE-III) and the General Practitioner Assessment of Cognition (GPCOG), focusing on their sensitivity, specificity, and utility in diverse healthcare contexts.

Purpose of Research: This analysis explores the clinical utility of the Addenbrooke's Cognitive Examination-III (ACE-III) and the General Practitioner Assessment of Cognition (GPCOG) for diagnosing cognitive disorders, including dementia, emphasizing their use in primary care and specialized settings.

Materials and Methods : A review of 37 peer-reviewed studies, including clinical trials and validation research, was conducted using databases like PubMed and Google Scholar. Keywords included "GPCOG," "ACE-III," and "cognitive screening."

Results : ACE-III shows high diagnostic accuracy, with sensitivity and specificity exceeding 93% and 96%. It excels in assessing complex dementia but is time-intensive and requires trained personnel, limiting its use in primary care. Conversely, GPCOG is a quick, user-friendly tool suited for primary care but lacks the depth for detailed diagnostics.

Conclusions : ACE-III is optimal for detailed evaluations in specialized settings, while GPCOG excels in rapid primary care screening. Combined, they enhance early detection and management of cognitive disorders.

Keywords: Cognitive screening tools, Dementia diagnosis, ACE-III, GPCOG, Primary and specialized healthcare settings

Introduction

The growing number of elderly individuals in the population is increasing the need for effective tools for early detection of cognitive impairments, especially in primary healthcare and emergency departments. Cognitive issues, such as dementia, significantly impact patient's quality of life and present challenges to the healthcare system. Therefore, available screening tools, such as the General Practitioner Assessment of Cognition (GPCOG) and Addenbrooke's Cognitive Examination (ACE), are widely used for cognitive assessment of patients in primary care and emergency settings [Brodaty et al., 2004; Wojtowicz & Larner, 2015; Schofield et al., 2010]. GPCOG, developed to quickly detect cognitive impairments in elderly patients, has proven to be both accurate and easy to use, making it valuable for general practitioners and specialists [Brodaty, Kemp and Low, 2004]. Its effectiveness in detecting dementia, compared to other tools such as the Mini-Mental State Examination (MMSE), has been confirmed in studies, highlighting its utility in clinical practice [Brodaty et al 2016]. On the other hand, Recent studies have demonstrated the utility of the ACE-III in detecting early stages of cognitive decline and dementia in both primary and secondary care settings, such as emergency departments and geriatric wards [Beishon et al., 2019; Carpenter et al., 2019]. Its use has been particularly valuable in screening for Alzheimer's disease and frontotemporal dementia, where early identification is key to managing disease progression [Hsieh et al., 2013].

Both tools, although differing in scope and application, play a critical role in the early identification of cognitive impairments, which can improve the quality of care for elderly patients and optimize medical interventions [Gostyńska & Ostrowska 2018, Shenkin et al., 2019]. The aim of this article is to popularize and compare the effectiveness of two screening tools - the CPCOG and the ACE - in detecting cognitive impairments in adults. In practice, doctors more often use other diagnostic tools or refrain from using any standardized screening tests at all, which may result from a lack of proper training, time constraints or low awareness of these tests in the medical community [Chmiela T, Dobrakowski P, Łabuz-Roszak B, Gorzkowska A. Diagnosis of cognitive disorders in primary health care in Poland. Psychiatr Pol. 2023 Feb 28;57(1):65-77]. This analysis seeks to raise awareness among clinicians as well as clarify which tool performs more effectively in specific clinical contexts and how each can assist healthcare providers in the prompt identification of cognitive deficits. This research is significant because early diagnosis of cognitive impairments enables timely therapeutic interventions, which can improve patients' quality of life and potentially delay the progression of more severe dementia symptoms. In the context of an aging society, widespread use of effective screening tools also could provide invaluable support for healthcare systems, allowing for better resource management and facilitating referrals for further specialized diagnostic evaluation.

Material and methods

This study employed a comprehensive approach by conducting an extensive literature review on the General Practitioner Assessment of Cognition (GPCOG) and the Addenbrooke's Cognitive Examination-III (ACE-III). A total of 37 peer-reviewed articles were analyzed to ensure a robust understanding of these tools, with particular focus on their practicality, clinical utility, and suitability across diverse healthcare settings. The review involved systematic searches across databases such as PubMed, NCBI, and Google Scholar, using relevant keywords including "GPCOG," "ACE-III," "cognitive screening," "cognitive function," "cognitive impairment," "dementia," and "delirium." By synthesizing data from this diverse body of literature, the study aimed to provide a nuanced evaluation and comparison of these two cognitive assessment instruments.

General Practitioner Assessment of Cognition

The General Practitioner Assessment of Cognition (GPCOG) is a promising and efficient cognitive screening tool designed specifically for primary care settings, with a particular focus on its use by general practitioners (Brodaty et al., 2004; Park & Kim, 2010; Brodaty et al., 2006; Wojtowicz & Larner, 2016; Brodaty & Pond, 2005; Tsai et al., 2023; Gee et al., 2013). It serves as an essential method for detecting early signs of cognitive decline and dementia, particularly in at-risk populations such as older adults.

The GPCOG consists of two main components: the GPCOG-patient examination (maximum score: 9 points) and the GPCOG-informant interview (maximum score: 6 points). The patient examination assesses a range of cognitive functions, including time orientation, visuospatial skills (measured through a clock-drawing task), episodic memory (based on recall of a recent news event), and delayed recall (assessed by recalling a name and address). A score below 9 on the patient component indicates the need for further investigation, including an interview with a close informant to assess daily functioning, which can further support the identification of cognitive impairment (Brodaty et al., 2004; Wojtowicz & Larner, 2015; Gostyńska & Ostrowska, 2018). The informant interview evaluates issues such as memory for recent conversations, the ability to manage finances and medications, difficulties with word-finding, and the need for assistance in traveling. A score of 0-3 on the informant portion suggests potential cognitive disorders, particularly when corroborated by the patient examination.

The patient examination component of the GPCOG has been found to correlate with several demographic and psychological variables, such as age (Tsang, 2015), education level, and depression severity. Regression analyses indicate that age is the most significant predictor of performance on this section, underscoring its utility in identifying age-related cognitive decline. Interestingly, the informant interview component of the GPCOG has demonstrated a remarkable ability to yield unbiased results, ensuring that the patient's cognitive status is assessed with minimal influence from social and cultural biases (Brodaty et al., 2004; Sze et al., 2015).

In a study by Patil (2019), the GPCOG was employed in a busy outpatient clinic for rapid cognitive screening, alongside other established tools. The research underscored the substantial prevalence of cognitive impairment among geriatric patients and demonstrated the GPCOG's efficiency and effectiveness in identifying early cognitive decline (Brodaty, 2003;

Brodaty et al., 2016; Brodaty & Pond, 2005). The tool has also proven valuable in non-cognitive contexts, such as monitoring postoperative cognitive function and evaluating treatment effects in conditions like hypertension (Smith et al., 2013; Skybchyk & Pylypiv, 2020).

Internationally, the GPCOG has been adapted into various languages and has shown high diagnostic accuracy across diverse populations. For example, the Chinese version of the GPCOG (GPCOG-C) demonstrated high sensitivity (97%) and specificity (89%) in detecting dementia, even outperforming other widely used screening tools like the MMSE (Li et al., 2013; Seeher & Brodaty, 2017). This version also offers the advantage of a shorter administration time due to its sequential two-stage process, improving the tool's practicality in busy clinical settings.

The Italian version of the GPCOG (GPCOG-It) was similarly validated, showing high sensitivity (82%) and specificity (92%), making it an effective screening tool for Italian general practitioners (Pirani et al., 2010). This efficiency, combined with the brief administration time required for both the patient and informant interviews, enhances its utility for primary care providers.

When comparing the GPCOG to the Mini-Mental State Examination (MMSE), several studies have revealed that the two tests exhibit comparable diagnostic performance. However, the GPCOG has a distinct advantage in ruling out dementia with high negative predictive values (Yokomizo et al., 2018). The French version of the GPCOG has also been validated in psychogeriatric populations, achieving high sensitivity (96%) and specificity (62%), demonstrating its reliability even when administered by non-specialized carers (Thomas et al., 2006). The GPCOG’s ability to quickly assess patients makes it an invaluable tool in scenarios where the MMSE’s longer administration time may not be feasible.

Despite its advantages, the GPCOG has some limitations. It remains a screening tool rather than a definitive diagnostic instrument, and subtle cognitive changes, particularly in the early stages of neurodegenerative diseases, may go undetected (Brodaty et al., 2004). Additionally, while the GPCOG's reliability is high for the patient examination, scoring errors in the informant interview component can arise, especially in primary care settings where proper training may be lacking (Wojtowicz & Larner, 2015). These challenges highlight the need for thorough training and quality control in GPCOG administration to maximize its effectiveness.

Although minimal, cultural and educational biases should also be considered when interpreting GPCOG results (Yokomizo et al., 2018). A study in Brazil emphasized these concerns, particularly in low-education populations, suggesting the need for further research to refine cut-off points and optimize the tool's diagnostic performance across different sociocultural contexts (Yokomizo et al., 2018).

Ultimately, the General Practitioner Assessment of Cognition (GPCOG) offers a promising and efficient approach to cognitive screening in primary care. With strong psychometric properties, adaptability across languages and cultures, and high diagnostic accuracy in detecting cognitive impairment, it is a valuable tool for early dementia detection, especially in busy clinical environments. However, proper training in its use and further validation studies are necessary to address its limitations and ensure its continued efficacy across diverse populations and healthcare systems

Addenbrooke's Cognitive Examination

The Addenbrooke's Cognitive Examination (ACE) is a complex neuropsychological test used to assess cognitive dysfunction in patients. In its original version, it was developed by Hodges in 1991, and over the years, subsequent modifications of the test have been published—the ACE-R in 2005 and the most current version, the ACE-III, in 2012. The primary goal and broadest application of the ACE test is the detection and differentiation of dementia in Alzheimer's disease and frontotemporal dementia, as well as progressive supranuclear palsy (Velayudhan et al., 2014). This is particularly important in the context of the increasing number of patients suffering from such conditions and the difficulties physicians face in differentiating between them.

The ACE-III test assesses a patient's cognitive functions across five domains: attention/orientation, memory, verbal fluency, language, and visuospatial functions. The maximum possible score is 100 points, with two standard cutoff points—88 and 82. A score greater than or equal to 88 indicates normal cognitive function, while a score below 82 suggests cognitive impairment. Scores falling within the range of 82–87 are considered inconclusive. Additionally, studies have reported a cutoff point of 61, which is particularly sensitive for distinguishing between mild and moderate dementia (Bruno & Schurmann

Vignaga, 2019). With the standard cutoff points of 82 and 88, the ACE-III demonstrates high sensitivity (93% and 100%, respectively) and specificity (100% and 96%) in diagnosing cognitive impairment (Hsieh et al., 2013).

Thus, it serves as a significant and reliable tool to aid in the clinical assessment of patients with various types of dementia. The structure of the test allows for the separate evaluation of individual cognitive domains, which is a crucial advantage in differentiating dementia in Alzheimer's disease (DAT) and frontotemporal dementia (FTD). In DAT, lower scores are observed in the domains of orientation, attention, and memory, whereas in FTD, lower scores are observed in the categories of verbal fluency and language, with memory being less affected. When these diseases are suspected, the ACE-III test can expedite a definitive diagnosis; however, it should be remembered that it plays only an auxiliary role and should always be corroborated with the patient's medical history, neuroimaging, and laboratory results (Bruno & Schurmann Vignaga, 2019; Elamin et al., 2016; Beishon et al., 2019).

It has also been reported that the ACE-III is effective in detecting early-onset dementia (EOD) and mild cognitive impairment (MCI) (Bruno & Schurmann Vignaga, 2019). The test differentiates between patients suffering from EOD and healthy individuals with high sensitivity and specificity. Proper diagnosis of EOD allows for the timely implementation of symptomatic therapy, establishes a prognosis for the disease course and patient survival, and reduces the number of unnecessary tests ordered during the diagnostic process (Elamin et al., 2016).

The utility of the ACE-III has been extensively evaluated and validated in numerous studies (Velayudhan et al., 2014; Hsieh et al., 2013; Elamin et al., 2016; Beishon et al., 2019), both in primary and specialty care settings. However, there are limitations to its effectiveness, particularly in detecting the behavioral variant of frontotemporal dementia (bvFTD). This limitation arises because the cognitive domains assessed by the ACE-III may remain intact during the early stages of bvFTD. At this stage, symptoms predominantly involve executive functions, which the ACE-III evaluates only within the verbal fluency category. Consequently, this creates a substantial gap in obtaining comprehensive information about higher brain functions using this test. Therefore, it is important to remember that the ACE-III serves only as an auxiliary tool for diagnosing a patient’s condition and monitoring disease progression (Elamin et al., 2016).

Table 1. Comparison of Cognitive Assessment Tools: ACE – III and CPCOG

CRITERIA	ACE – III	CPCOG
Purpose of use	Complex neuropsychological test. Important in detecting Alzheimer's disease, frontal dementia, progressive supranuclear palsy	Screening test used to assess cognitive disorders. Particularly important in evaluating the occurrence of MCI (mild cognitive impairment) and dementia.
Methodology	Assessment of the patient's cognitive functions in the following categories: 1) Attention/orientation 2) Memory 3) Verbal fluency 4) Language 5) Visuospatial functions	A more complex test consisting of: The patient's GPCOG examination, which includes: Recall test, questions about time orientation and recent events, clock drawing test, GPCOG information sheet conducted with a close person: Interview consisting of 6 questions asked to a close person

nterpretation	Max 100 points A score of >=88 indicates normal cognitive function A score of 82-87 remains inconclusive A score of <82 points indicates impaired cognitive function 61 points is the cut-off point for differentiating mild and moderate dementia	STEP 1 patient examination - max 9 points = no cognitive disorders, further tests are not necessary 5-8 points more information needed, interview a close person (STEP 2) 0-5 points indicate cognitive disorders - further tests are required STEP 2 max 6 points A result of 0-3 points indicates cognitive disorders - further tests are necessary
Sensitivity	93% for a cut-off point of 82 100% for a cut-off point of 88 in diagnosing cognitive disorders	79% in detecting probable dementia 86.6% in detecting mild cognitive impairment MCI
Specifity	100% for a cut-off point of 82 96% for a cut-off point of 88 in diagnosing cognitive disorders	92% in detecting probable dementia 89.1% in detecting mild cognitive impairment MCI

Pros	Very high reliability (high values of both sensitivity and specificity of the test). The structure of the test allows for the assessment of individual cognitive functions of the patient separately, The usefulness of ACE has been repeatedly confirmed and validated in various studies.	Low cost, Speed (4-6 minutes) minimal impact of cultural and linguistic differences, and a small impact of education on test results. Sensitivity and specificity comparable to MMSE with significantly shorter execution time and lower level of complexity
Limitations	Limited ability of the test to assess early impairments in some cognitive domains Limited ability to assess executive functions, as the only executive functions assessed are those in the verbal fluency category	This is a screening tool and diagnoses cannot be made based on the results of this test. Some studies have shown incorrect use of the test, which indicates that its use requires training. It may not identify subtle changes in cognitive function in the early stages of some diseases.

Situations of particular usefulness of the test	Diagnosis and differentiation of Alzheimer's disease and frontotemporal dementia Detection of early onset dementia (EOD) Detection of mild cognitive impairment (MCI)	Screening assessment for dementia and mild cognitive impairment.
Situations of limited test usability	Detection of behavioral variant frontotemporal dementia (bvFTD)	Little utility in early stages of neurodegenerative diseases.

Conclusion

The General Practitioner Assessment of Cognition (GPCOG) is an efficient and practical cognitive screening tool for primary care, designed to assess cognitive performance through a two-component structure. The first component evaluates cognitive functions such as time orientation, visuospatial abilities (via a clock-drawing test), and memory (using recall tasks). If the patient scores below 9 points, an informant interview is conducted, assessing daily functioning such as memory for conversations and medication management. This dual approach ensures both cognitive abilities and functional capacity are examined, making it valuable in early detection of cognitive disorders in geriatric populations (Brodaty et al., 2004; Brodaty & Pond, 2005; Tsai et al., 2023).

The GPCOG has demonstrated versatility in various settings, including dementia screening, postoperative cognitive decline, and monitoring therapeutic interventions, such as those for

hypertension (Smith et al., 2013; Skybchyk & Pylypiv, 2020). Its validity is supported by studies showing high sensitivity and specificity, with a negative predictive value of 99% and a positive predictive value of 72%, aiding in ruling out dementia and prompting further assessment (Brodaty et al., 2002; Li et al., 2013). Its reliability across diverse cultural contexts is comparable to the Mini-Mental State Examination (MMSE), particularly in primary care settings where time is limited (Brodaty et al., 2016).

However, the GPCOG has limitations, including potential scoring biases, especially in culturally diverse populations, and the need for proper training to avoid errors (Yokomizo et al., 2018; Wojtowicz & Larner, 2016). While effective in ruling out dementia, it may be less sensitive to subtle early-stage cognitive changes (Brodaty et al., 2004). Therefore, it should be used as part of a broader diagnostic strategy, not as the sole diagnostic tool (Brodaty et al., 2006; Brodaty & Pond, 2005).

In contrast, the Addenbrooke's Cognitive Examination-III (ACE-III) offers a more detailed evaluation of five cognitive domains: attention, memory, verbal fluency, language, and visuospatial abilities. It excels in diagnosing conditions such as Alzheimer's disease, frontotemporal dementia, and progressive supranuclear palsy, offering high sensitivity (93-100%) and specificity (96-100%) at standard cutoffs. However, its complexity and need for specialized training make it less practical for routine screening, particularly in primary care settings (Velayudhan et al., 2014; Bruno & Schurmann Vignaga, 2019; Hsieh et al., 2013).

While the ACE-III provides an in-depth cognitive assessment, it may miss early behavioral variant frontotemporal dementia (bvFTD), which primarily affects executive functions, an area less comprehensively evaluated by the ACE-III (Elamin et al., 2016). Thus, its use should always complement other diagnostic tools, such as neuroimaging and patient history, to create a complete clinical picture (Elamin et al., 2016; Beishon et al., 2019).

In summary, both the GPCOG and ACE-III are valuable tools in cognitive assessment. The GPCOG excels in quick, efficient screening, especially in primary care, while the ACE-III provides a more detailed and specific assessment for diagnosing dementia, particularly in specialty care. Together, they offer complementary strengths, supporting a comprehensive approach to cognitive health in aging populations (Bruno & Schurmann Vignaga, 2019; Hsieh et al., 2013).

Disclosure:

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All authors have read and agreed to the published version of the manuscript.

Conflict of Interest Statement:

The authors declare no conflicts of interest.

Funding Statement:

This study received no financial support.

Institutional Review Board Statement:

Not applicable.

Informed Consent Statement:

Not applicable.

Data Availability Statement:

Data sharing is not applicable to this article, as no new data were created or analyzed in this study.

Acknowledgments:

None.

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