Global Perspectives on Brief Cognitive Assessments for Dementia Diagnosis

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Abstract

Background: Timely diagnosis of dementia is a global healthcare priority, particularly in low to middle income countries where rapid increases in older adult populations are expected.

Objective: To investigate global perspectives on the role of brief cognitive assessments (BCAs) in dementia diagnosis, strengths and limitations of existing measures, and future directions and needs.

Methods: This is a qualitative study of 18 dementia experts from different areas of the world. Participants were selected using purposeful sampling based on the following criteria: 1) practicing in countries with projected growth of older adult population of over 100% by 2050; 2) expertise in dementia diagnosis and treatment; 3) involvement in clinical practice and training; and 4) recognition as a national dementia expert based on leadership positions within healthcare system, research, and/or policy work. Participants were individually interviewed in their language of

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choice over secure videoconference sessions. Interviews were analyzed by a multidisciplinary team using theme identification approach.

Results: Four domains with subthemes emerged illustrating participants' perspectives: 1) strengths of BCAs; 2) limitations of BCAs; 3) needs related to the use of BCAs; and 4) characteristics of an ideal BCA. While most experts agreed that BCAs were important and useful for dementia diagnosis, the themes emphasized the need for development and validation of novel measures that are sensitive, psychometrically sound, and culturally appropriate.

Conclusion: BCAs are important for guiding diagnosis and care for dementia patients. Findings provide a roadmap for novel BCA development to assist in diagnostic decision making for clinicians serving a rapidly growing and diverse dementia population.

INTRODUCTION

With increasing longevity, the global burden of dementia is growing exponentially [1]. Whereas high income countries have undergone rapid longevity increases over the last 30 years and projected growth rates have slowed, the majority of low to middle income countries (LMIC) are anticipated to experience rapid growth of older adult populations of 100% or more in the next 30 years [1]. One billion people aged 60 and over are projected in LMIC by 2030, and 1.7 billion by 2050 [2]. Yet, dementia remains widely underdiagnosed and misdiagnosed, particularly in LMIC [3]. Most experts agree that timely dementia diagnosis is a global healthcare priority [1, 3], and its benefits include opportunities to identify etiological causes, to inform and coordinate medical care, to enable future planning, to address safety issues, and to identify appropriate candidates for clinical trials [4, 5].

Cognitive assessment is important for diagnosis and disease monitoring [6]; however, neuropsychological services are limited in LMIC. For example, the estimated number of neuropsychologists per national population is less than 1 per 500,000 citizens in India and South Africa, among others [7]. Given these limitations, brief cognitive assessments (BCAs), such as MMSE [8] and MoCA [9], may be more applicable for detection of dementia in LMIC, yet the utility and feasibility of using these measures across different settings and cultures is poorly understood.

This study aimed to understand strengths, weaknesses, and needs associated with the use of BCAs for dementia diagnosis among countries with anticipated rapid growth in the aging population to inform future global research directions, clinical interventions, and policy directives.

MATERIALS AND METHODS

Design

In this qualitative descriptive study, we interviewed dementia experts from different areas of the world with a particular focus on experts in LMIC. We used purposeful sampling [10], which involves identifying and selecting individuals who are especially knowledgeable about or experienced with a phenomenon of interest, to select participants based on the criteria described below. The study was conducted in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) reporting guidelines (Supplementary Table 1) [11].

Participants and setting

We selected experts in dementia diagnosis who could speak both to their own clinical practice and to their national situation around this topic. Specifically, participants were selected based on the following criteria: 1) practicing in countries with projected growth of population aged 60 years or older of over 100% between 2017 and 2050 based on United Nations Department of Economic and Social Affairs Population Division estimates [2]; 2) established expertise in dementia diagnosis and treatment (included disciplines were geriatric medicine, geriatric psychiatry, neurology, neuropsychology, and psychiatry); 3) current involvement in clinical practice and training; and 4) recognition as a national dementia expert based on leadership positions within healthcare system, research, and/or policy work. First, we identified a pool of potential participants based on recommendation from local Alzheimer's Associations, professional networks, and multinational studies (e.g., Multi-Partner Consortium to Expand Dementia Research in Latin America). Then, each identified expert was contacted via email and invited to participate in a brief pre-interview survey and a 1-h individual interview via a secure videoconferencing call. A total of 32 experts were contacted, and 18 responded and agreed to take part in the study. The remaining 14 experts did not respond to initial or follow-up emails. Participants were interviewed from August 2019 to September 2020. All participants provided oral informed consent. The study was approved by the Institutional Review Board and Human Research Protection Program at University of California San Francisco.

Data collection

A brief pre-interview survey was sent out to participants via a protected online survey platform (Supplementary Table 2). An interview guide was developed by our multidisciplinary team based on our study goals and reviewed by a leader in global health and dementia and then piloted with a dementia expert. The interviews were semi-structured and covered the following areas: 1) process for diagnosing dementia; 2) facilitators and barriers to dementia diagnosis and use of standardized cognitive assessment as a part of diagnostic process; 3) current needs for diagnostic practice improvements; and 4) perspectives on an ideal BCA measure for dementia diagnosis (Supplementary Table 3). All interviews were digitally recorded, translated if not conducted in English, and transcribed for analysis. Interviews lasted approximately 1 h and were conducted via secure videoconferencing by trained multidisciplinary researchers: ET (female, postdoctoral fellow in neuropsychology), AB (female, assistant professor, medical anthropologist, expertise in

qualitative medical research), SDPE (female, Atlantic Fellow, geriatrician), MPC (female, Atlantic Fellow, neurologist), SK (female, physician scientist), TAR (female, assistant professor, epidemiologist, expertise in qualitative methods), LMM (female, Atlantic Fellow, neuropsychologist), MOO (female, Atlantic Fellow, neuropsychologist), MDCP (female, Atlantic Fellow, neurologist), SZ (male, Atlantic Fellow, neuropsychologist), AAM (female, Atlantic Fellow, neurologist), and HI (male, Atlantic Fellow, geriatrician).

Data analysis

We used content analysis to analyze the data to deductively and inductively identify key domains and themes. We transcribed interview data and analyzed the transcripts using ATLAS.ti, a qualitative data analysis software. Coding was conducted through an iterative process. We identified four key domains based on our study goals and the interview guide that included: 1) current strengths of existing BCAs; 2) current limitations of existing BCAs; 3) needs related to the use of BCAs; and 4) characteristics of an ideal BCA measure. We deductively coded the data to confirm these domains and identify content for each of these domains. We then inductively identified and derived themes within these domains. First, a subset of de-identified transcripts (5/18) was read and coded independently by each member of a multidisciplinary team of 3–5 coders. Then, the coded transcripts were reviewed together by the whole team and a codebook was developed and agreed upon by all coders. Next, the first and the second authors used the developed code book to code the remaining de-identified transcripts (13/18). If new codes or themes emerged in these transcripts, they were reviewed with the multidisciplinary team at intervals and added to the codebook. Coders met regularly, and any disagreements were resolved via continuous iterative consensus discussions. Theme saturation was determined when no new information emerged within a given theme.

RESULTS

Characteristics of the 18 countries represented by participants are presented in Table 1. Out of 18 participants, 9 were neurologists, 3 were neuropsychologists, 3 were geriatricians, 2 were psychiatrists, and 1 was a geriatric psychiatrist. Fourteen participants' primary affiliation was a teaching hospital, 3 participants' affiliation was a private institution, and 1 practiced primarily in a daycare center. Mean years of dementia clinical practice across participants was 18.6 ± 9.7 years.

Pre-interview survey

Based on the pre-interview survey data, the most commonly used brief cognitive measures in their practice were the MMSE (11/18) followed by the MoCA (2/18). The remaining 5 participants indicated "another paper-based BCA" as a most commonly used measure, 4 of whom wrote in examples of other measures used and 1 of whom did not.

Themes

Within our four key domains we derived themes regarding the use of BCAs for dementia diagnosis. These domains were: 1) current strengths of existing BCAs; 2) current limitations of existing BCAs; 3) needs related to the use of BCAs; and 4) characteristics of an

ideal BCA. The summary of the domains, themes, and exemplary quotes are presented in Tables 2-5. Overall, most experts agreed on the usefulness of BCAs in diagnosis of dementia and associated cognitive disorders in older age but reported a number of important limitations of available BCAs and critical needs for future development of BCAs for use in dementia diagnosis in their countries. The most salient areas for improvement were needs for sensitive, psychometrically sound, and culturally appropriate BCAs.

Domain 1: Strengths of current BCAs

Three themes emerged as strengths of currently existing BCAs: 1) BCAs that are normed and validated in local populations work well; 2) BCAs are brief and easy to administer; 3) BCAs help confirm diagnosis to facilitate access to services (Table 2).

Within the first theme, a few experts noted that the most useful BCAs were those that had been validated and normed in local populations, particularly when adapted to country-specific languages and educational attainment levels. For example, one participant said:

> Neurologist, Asia: Yeah, low education, we can work, we have translated them [BCAs] into local language. Yeah, we've done that. We have [another locally validated BCA] also which is actually modeled on your, you know, [other BCAs], and is translated I think into more than 20 [country-specific] languages.

The second theme highlighted another strength of existing BCAs—brevity and ease of administration which are critical for busy clinical practices. For instance, one of the experts reported:

> Geriatrician, South America: I think that [BCA], for example, takes about 15 minutes which is an adequate time.

It is worth noting that these strengths were not endorsed by other experts who reported having more time-constrained visits with patients and thus did not find a 15-min BCA appropriate for use (discussed in detail in Domain 2 below).

The final theme within this domain focused on the importance and usefulness of BCAs in the diagnosis of dementia, and most experts said that objective assessment of cognitive impairment is helpful for diagnostic decision making, especially in the context of limited or unreliable history. Additionally, some experts highlighted the BCAs' usefulness as a formal confirmation of a suspected diagnosis of dementia which in turn helps facilitate patient access to services or treatment. Specifically, one of the participants noted:

> Geriatrician, Asia: I think they are extremely helpful. Dementia remains a clinical diagnosis, so we rely a lot on history. Some relatives did not observe any changes. While some others who are more concerned may give exaggerated history. In both cases, the cognitive tests help fill in the gap for the physicians.

While another participant said:

> Neurologist, Asia: Well, I think [BCA] is probably the most widely used in [country]. There're a few reasons to it – in the past, for us to prescribe

[medication], we would need a [BCA] score, and/or CDR [Clinical Dementia Rating] assessment.

Domain 2: Limitations of current BCAs

Within this domain, six themes were identified: 1) limited access to neuropsychology for administration of the BCAs; 2) limited time effectiveness of current BCAs; 3) poor validation of current BCAs; 4) limited applicability due to language, education, and literacy variables; 5) limited applicability due to cultural biases; and 6) limited diagnostic accuracy and sensitivity to disease severity (Table 3).

In particular, the first theme emerged as some experts said that a primary limitation of the use of BCAs in dementia diagnosis is limited access to neuropsychology services even in tertiary specialty clinics. As an example, one participant reported:

Neurologist, Europe: Even what we understand by [a memory unit] is also quite variable regarding access to tests. But regarding the barriers that exist to make these diagnoses, on a basic level, not all of the patients have access to neuropsychological testing, even when it is required … Regarding memory clinics, there are a lot of inequities regarding neuropsychological testing and biomarker access.

The second theme highlighted that the length of the BCAs was inappropriate for use in clinics with very brief visit times. In particular, as neuropsychological services are limited (Domain 2 Theme 1), most experts said that administration and interpretation of BCAs is mostly conducted by medical specialists in tertiary clinics, many of whom have limited visit times and are often unable to implement BCAs due to lack of time. Most experts also reported that BCAs are almost never administered in primary care practice from where patients are typically referred due to even more stringent time constraints in general care clinics. For example, one participant noted:

Neuropsychologist, Africa: So, as you can imagine, in 10 minutes you can't really ask that many questions. So, their [general practitioners'] questions are usually, you know, really limited because they have to get through their client load in the day.

The third theme that emerged within the domain of limitations was the lack of country-specific normative data and validation studies on the BCAs. Most experts reported difficulties of adopting and translating the results of findings on BCAs, such as MMSE or MoCA, from studies conducted in Western countries to their patient populations. Moreover, even when local studies were available, many experts felt that the quality of such studies was poor and had poor generalizability for clinical use. For example, one participant suggested:

Neuropsychologist, Africa: Unfortunately, at this stage we don't have any validated assessments that we use at all … So, yeah, so they're just not validated for this population. I don't think I would get an accurate depiction of what is happening for that person cognitively because the test was developed for a different population.

Another echoed this sentiment, noting:

Geriatrician, Asia: Previous validation process, many publications did not carry out their methodology well … The diagnosis was a little messy… Choosing a

population was also a big problem. If they compare very severe patients with normal, then it should be easy … Some studies did not even have enough sample size. We cannot really use their findings as normative data. It is a big limitation. This leads to a misunderstanding among non-specialist users [practitioners] who rely on those cut-off points.

Within the fourth theme, almost all experts reported challenges in the use of existing BCAs for dementia diagnosis related to their poor applicability in linguistically and educationally diverse patients. With regard to language, most experts agreed that many of the current BCAs are either not available in the most widely spoken language in their country or, even when translated and validated in the most widely spoken language, are not applicable in multilingual patient populations particularly in countries characterized by rich linguistic diversity. For example, one of the participants said:

> Neurologist, Middle East: I can't do the whole [BCA] because you can't translate it all to [local language]. Patients don't understand everything in the [BCA].

While another added, with regard to education:

> Neuropsychologist, Europe: Some people do not perform well on the cognitive tests, but the main reason for that is low education.

Most experts also said that existing BCAs are practically impossible to use in illiterate populations—an issue which was particularly prominent in countries with a high percentage of older adults with little to no literacy skills. As one participant reported:

> Neurologist, Africa: And then there's a group of patients whose literacy levels are so low that really you can't use these assessments, so you then have to modify things and, you know, just do some simple question-based assessment, which is really off the cuff of your own sleeve rather than, you know, something that is formally written up.

The fifth theme emphasized that, beyond linguistic and educational barriers, current BCAs also have poor applicability due to cultural biases in their countries, particularly those characterized by rich ethnocultural diversity (Table 1). Specifically, participants emphasized challenges related to poor familiarity with test stimuli and standardized testing paradigms in ethnically and culturally diverse populations within their countries. As one participant said:

> Neurologist, Middle East: It's tough. Some people, they don't even know the dates, the day of the week. They don't know it. And they just don't know, it's a cultural thing. They're [an ethnic group], there is no need to know it. So, once you encounter that patient, you can't assist the patient very well.

The final theme within this domain emerged from the experts' reports that current BCAs have poor sensitivity to mild deficits and cognitive change, thus limiting their usefulness for early detection of dementia or for monitoring disease progression. For example, one participant noted:

> Neurologist, Africa: We all know that these cognitive assessments can be passed by people who have dementia, and I have certainly seen patients who have been really

high functioning in the first visit. They will pass the [BCAs], and you still know that they're dementing, you see?

Domain 3: Needs related to use of current BCAs

Three key themes emerged as most salient needs related to the use of BCAs for dementia diagnosis: 1) need for better validation studies of BCAs; 2) need for the BCAs that could be administered by non-specialists; and 3) need for an organized infrastructure for standardization and harmonization of BCAs (Table 4). First, almost all experts emphasized the need for high quality normative and validation studies on existing or novel BCAs, which would appropriately represent culturally, linguistically, and educationally diverse groups within their countries. For instance, one participant reported:

Geriatrician, Middle East: We should not be biased by norms for other countries for which the illiteracy rate in elderly population is far lower than [country]. So, I think there is an improvement in including a more representative sample including the illiterates in normative data.

Second, some participants highlighted the need for BCAs to be easily administered by non-physicians, which would allow for more efficient use of visit time both in specialty and non-specialty practices. As a matter of fact, some participants said that they have implemented a model of care where administration of BCAs is done by medical support staff, which allows them to diagnose more patients efficiently even in the context of time constraints. For example, one participant said:

Neurologist, Asia: So, the normal time, even in dementia clinic, we see at least 20 patients [per day]. So, the normal time that you can dedicate for each patient is, unfortunately, quite limited. One way of actually helping with that is that we usually would have research assistants or maybe a neuropsychologist working with you during your clinic time where they can do the assessment, and then the patient can come back to you, after a few patients later.

Finally, the third theme emerged as some experts endorsed the need for organized infrastructure for standardization and harmonization of BCAs across clinical practices in their countries. Participants said that having a reliable infrastructure would allow for better coordination and continuity of care as well as integration of diagnosis into treatment considerations, particularly in primary care clinics following a specialists' appointment. As one of the participants noted:

Neuropsychologist, Europe: For example, [BC As], I think that this type of test should be available to everyone who works with elders in order to – to be aware of what's – if there's something that's changed with the elder and suggest further screening.

Domain 4: Envisioning an ideal BCA

Across participants, five major characteristics of an ideal BCA emerged: 1) validity and applicability in diverse populations; 2) brevity (<10 min) and ease of administration; 3) assessment of multiple cognitive domains and daily functions; 4) sensitivity to early stages

of decline; and 5) potential for technology-assisted administration (Table 5). We illustrate each characteristic with exemplary quotes from research participants below.

First, most experts highlighted that the ideal measure would exhibit cultural validity and applicability across diverse populations (language, education, literacy, culture) both within and across counties. For example, one participant said:

> Neurologist, Africa: And obviously, if we had something that was very well validated across different cultures, that was totally literacy independent … but I don't think there have been any that have been validated, really, across different cultures.

While another supported this notion by noting:

> Neuropsychologist, Africa: Yeah, yeah, and obviously language, you know, not everybody speaks the [primary local language], so making sure that whatever tests that will be developed can be translated. And sometimes it's not just a matter of translating tests from another country because it might not work. Like, a direct translation from a different country might not work.

The second characteristic of the ideal BCA that was endorsed by most experts was greater brevity (length <10 min) and ease of administration compared to existing BCAs, illustrated in the following quote from one of the participants:

> Neuropsychologist, Africa: As I said, people are seen for 5 or 10 minutes and then they need to see the next patient. So, something that is really, really brief. Something that can be administered in, you know, 10 minutes … Something that can be administered by a nurse, for example, or a healthcare assistant. Something that can be easily scored or something that can self-score.

Third, many participants endorsed the notion that the ideal BCA would include assessment of multiple cognitive domains to comprehensively characterize the patients' cognitive profile, which current BCAs do not do well. Moreover, some experts felt that inclusion of brief standardized informant measures of everyday function would substantially improve diagnosis and monitoring. Specifically, one participant reported:

> Neuropsychologist, Europe: Except from independent living, I would test five specific domains: working memory, visuospatial abilities, attention, language, and executive functions.

Within this theme, experts said that multidomain assessment would facilitate accuracy in differential diagnosis, particularly in ruling out non-neurodegenerative causes. As one participant said:

> Geriatric Psychiatrist, Middle East: I need to rule out several things. So, I need to rule out that the person has delirium, for example. So, the assessment tool needs to rule out delirium, not dementia. I don't want people to be given a diagnosis of dementia when they have a UTI and they are not diagnosed.

The fourth characteristic of the ideal BCA focused on the sensitivity to early stages of cognitive impairment, which many experts felt was not possible with existing BCAs. Some

experts reported concerns regarding the discrepancy between development of novel disease biomarkers and limited progress in development of clinical assessment measures. As one participant summarized:

> Psychiatrist, North America: I think one of the biggest challenges is treating a pre-symptomatic patient. There have been a lot of efforts to identify diseases 20 years before they present symptoms or to even identify people who are born with the disease, like genetic Alzheimer's mutations. But how do these developments match with our clinical tools? So, I think this is one of the biggest challenges, to develop clinical evaluations that are more sensitive in earlier stages.

The fifth and final characteristic that emerged within this domain was related to experts' reports on potential use of technology in administration, scoring, and interpretation of BCA results. Specifically, participants described technology-assisted testing as promising as more older adults in their countries start using digital devices in their daily lives. At the same time, experts agreed that most efficient use of technology for clinical evaluations would require self-administered measures that have been validated in their populations and offer user-friendly interpretation of results. As an example, one participant reported:

> Psychiatrist, Asia: And the automated scoring and interpretation by a computer would be perfect, particularly if based on a single test. There are definitely positives and negatives to this but, of course, if the examiner knows what they are doing and know how to read the results correctly, it would save a lot of much needed time.

DISCUSSION

This study identifies and characterizes perspectives from national experts on the use of BCAs for the diagnosis of dementia in older adults in 18 countries with rapid projected growth of older adult populations in the next 30 years [2]. Unlike past review studies on similar topics [12] that relied on published data in cohorts evaluated in the context of academic research, our study is based on qualitative analysis of interviews with dementia specialists in real-world clinical practice across the globe. Our results suggest that, while most dementia experts agree that objective brief assessment of cognitive symptoms is important for diagnostic decision making, existing BCAs have critical limitations and weaknesses that must be addressed for these countries to be prepared for the projected rapid increases in longevity. In discussing the results, we focus on the following critical areas for improvement: BCAs are needed that 1) are accurate at measuring cognition across diverse patients, and 2) can be easily integrated into existing clinical workflows.

Validating tests for patients with diverse backgrounds

Consistent with prior studies [12], we found that MMSE and MoCA were the most widely used instruments across participants. However, most participants reported poor applicability of these measures in patient populations with diverse language, education, and literacy backgrounds. Indeed, it is well documented that sociodemographic variables including age, sex, education, literacy, and language all impact MMSE, MoCA, and ACE-R performance [12-14]. Moreover, recent studies suggest that these variables can interact in their effects on performance and rates of decline [15], making interpretation of scores even more

challenging in diverse populations. Furthermore, our findings supported the results of a recent systematic review suggesting that most measures developed in Western countries do not perform well in illiterate populations and perhaps need to be combined with a functional assessment measure to ensure ecological validity [16].

Our participants clearly indicated a need for a better BCA measure and highlighted the importance of rigorous cultural adaptation. These findings are consistent with a recent review of standard neuropsychological measures which found that only a handful of instruments have undergone rigorous adaptive procedures, including translation, back-translation, review by an expert committee, and pilot testing of the translated instrument [17]. The development or adaptation of culturally appropriate BCAs requires collaboration with local experts both in neurodegenerative disease and in other sciences, such as anthropology, linguistics, and sociology. Moreover, tests need to be developed in accordance with an understanding of social determinants of health beyond typically assessed education, sex, and age and include such variables as literacy, occupational complexity, and other variables reflecting social, cultural, and economic contexts within and between countries [18]. Ideally, social determinants of health will be identified that appropriately adjust normative scores across diverse populations so that large samples can be leveraged to make these adjustments and the tests can be appropriately applied to diverse patients. This is particularly important given the cultural and linguistic heterogeneity within many countries that project rapid longevity increases (Table 1).

Finally, given wide recognition of the benefits of early detection [3-5], BCAs are needed that are sensitive to mild deficits and reliable at monitoring cognition over time. Indeed, the potential of novel cognitive measures to capture subtle early changes has been widely discussed in the literature [19, 20], but these promising developments have been largely limited to high income country populations. Therefore, future BCAs should address this critical gap that would not only facilitate diagnostic and treatment care pathways but also support efforts towards global healthcare equity in late life.

Workflow considerations

The length of the assessment was reported as one of the major limitations for the widescale use of BCAs for dementia diagnosis. This is consistent with studies conducted in the U.S., where more than half of surveyed primary care physicians reported lack of time during patient visits as a major barrier to conducting brief cognitive testing [21]. To address this limitation, a number of participants reported a need for BCAs that could be administered by medical support staff—a model that has been adopted by some physicians in the U.S. [21]. Interestingly, we also found an interest among participants in adopting technology-assisted BCA measures, which have been previously suggested to hold promise to alleviate time- and staff-related costs through automated scoring and interpretation of results [3, 22, 23]. Additionally, presentation of stimuli and response capture by a digital device could help to address the need for standardized administration across sites and providers with limited expertise, which was also highlighted as a limitation of paper-based BCAs by some participants. A particular advantage of computerized measures is the potential for self-administration, as highlighted by one of our participants. However, a recent review

found that substantial gaps in cultural adaptation and validation of these tools in diverse populations remain [24]. Additionally, systematic evaluation of the role of familiarity with technology, particularly in populations with limited access to existing technological devices, must be conducted prior to implementation of any digital measures in clinical practice [25, 26].

Future directions

Overall, our findings support the notion that novel BCAs that are sensitive, psychometrically sound, and culturally appropriate are critically needed, particularly in LMIC. These needs are more likely to be addressed via multinational cross-site collaborations, which would also facilitate standardization of care and harmonization of data beyond national, cultural, and linguistic borders. Novel approaches for adjusting normative standards based on sociodemographic variables across diverse populations within and between countries are needed to support accurate interpretation of BHA performance. International collaborative efforts of different stakeholders, including funding bodies, policy makers, academicians, and clinicians, are necessary to address the gaps in scientific rigor of development, validation, and implementation studies of future BCAs which can be equally useful for dementia diagnosis for clinicians around the world.

This study has a number of limitations. While all efforts were made to ensure appropriate representation of countries with greatest projected growth of older adult populations, our findings were limited to participants from countries within which we were able to conduct interviews. While we were unable to sample from all countries, we accomplished our objective of sufficient regional representation and achieved saturation in the thematic analyses. Second, our sample size, while appropriate for qualitative studies, was limited, although this limitation may be somewhat alleviated by our purposeful sampling strategy which allowed us to gather in-depth information regarding the topic of interest. Future studies should further explore the real-world use of BCAs in dementia clinical practices by either expanding the sample to other countries or utilizing a mixed methods approach for data collection.

Taken together, our findings highlight the strengths, limitations, and needs associated with use of brief cognitive measures for diagnosis of dementia in older adults in 18 countries around the world with rapid projected increases in older adult populations over the next 30 years. Development of psychometrically rigorous, well validated, and culturally appropriate measures is critically needed to ensure timely and accurate diagnosis of dementia globally, which may in turn help alleviate the burden of disease in countries with limited resources.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of 18 countries that were represented in the study

World Region	Country	Projected growth (%)[2],a	Literacy rate (%)[27],b	Mean years of school[27],c	Rural residence (%)[27],d	GDPPC (USD)[27],d	Gini index[28],e	Linguistic diversity index[29],f
Africa	Botswana	264	40	ND	31	$8,259	53.3	0.444
Africa	Kenya	247	57	ND	73	$1,711	40.8	0.901
Americas	Brazil	235	79	8.0	13	$8,921	53.9	0.032
Americas	Colombia	237	83	8.5	19	$6,651	50.4	0.030
Americas	Ecuador	208	73	8.8	36	$6,345	45.4	0.264
Americas	Mexico	244	81	8.9	20	$9,698	45.4	0.135
Americas	Nicaragua	276	56	ND	41	$2,029	46.2	0.081
Americas	Peru	219	79	9.7	22	$6,947	42.8	0.376
Asia	India	203	45	ND	66	$2,016	37.8	0.930
Asia	Indonesia	223	74	8.2	45	$3,894	39.0	0.846
Asia	Kyrgyzstan	220	97	ND	64	$1,281	27.7	0.670
Asia	Taiwan	204	ND	ND	ND	ND	ND	ND
Asia	Thailand	208	79	8.5	50	$7,274	36.4	0.753
Europe	Greece	157	95	10.3	21	$20,324	34.4	0.175
Europe	Spain	166	95	10.3	20	$30,524	34.7	0.438
Middle East	Egypt	195	33	9.0	57	$2,549	31.5	0.509
Middle East	Jordan	270	91	ND	9	$4,248	33.7	0.484
Middle East	UAE	779	69	12.5	13	$43,005	32.5	0.777

GDPPC, gross domestic product per capita; ND, no data; UAE, United Arab Emirates.

a Projected growth of population aged 60 and above between 2017 and 2050.

b Literacy rate among population aged 65 and above; reference year: 2013 (Botswana), 2015 (Nicaragua, Thailand, UAE), 2017 (Ecuador, Egypt), 2018 (Brazil, Colombia, Greece, India, Indonesia, Jordan, Kenya, Kyrgyzstan, Mexico, Peru, Spain).

c Mean years of formal schooling among adults aged 25 and above; reference year: 2016 (Greece), 2017 (Ecuador, Egypt), 2018 (Brazil, Colombia, Indonesia, Mexico, Peru, Spain, Thailand, UAE).

d Rural residence among adults aged 25 and above; reference year: 2018 (all).

e Gini index measures the deviation of the actual income distribution from a hypothetical perfectly equal distribution with values ranging from 0 (perfect equality) to 100 (perfect inequality); reference year: 2010 (Jordan), 2011 (India), 2014 (Nicaragua, UAE), 2015 (Botswana, Kenya), 2017 (Egypt, Greece, Spain), 2018 (Brazil, Colombia, Ecuador, Indonesia, Kyrgyzstan, Mexico, Peru, Thailand).

[f]
Linguistic diversity index is based on the population of each language spoken in the country as a proportion of the total population with values ranging from 0 (no diversity, everyone has the same primary language) to 1 (total diversity, no two people have the same primary language); reference year: 2009 (all).

Table 2

Domain 1 Strengths of Brief Cognitive Assessments (BCAs): themes and exemplary quotes

Themes	Quotes
BCAs normed and validated in local populations work well	*Neurologist, Europe: It works quite well. It has been culturally adapted in different countries, and I know that it has been translated into other languages and is in several international journal publications.*
	Geriatric Psychiatrist, Middle East: Validation, yeah. So we use either [BCA 1] or [BCA 2] which also we have validated and it's on the way for publication.
BCAs are brief and easy to administer	*Neurologist, South America: I like [BCAs], because it seems to me that screening should be short tests. I find that they are easy to apply.*
	Neuropsychologist, South America: It's so popular, it's very short. It's very easy for someone who does not have time to do many assessments.
BCAs help confirm diagnosis to facilitate access to services	*Psychiatrist, Asia: We only do [BCAs] to confirm the diagnosis with a purpose to officially document the report changes – that's it.*
	Neurologist, South America: In such a way, that with a brief cognitive test like [BCA], and a [functional measure] for function, already you have a confirmation of dementia.

Table 3

Domain 2 Limitations of Brief Cognitive Assessments (BCAs): themes and exemplary quotes

Themes	Quotes
Access to neuropsychology is limited, and BCAs are primarily administered by medical specialists	*Neuropsychologist, Europe: But I'm not very sure about the other cities of [country], and even more in [other parts of the country], there are no professionals – neuropsychologists in these – in these places unfortunately.* *Neurologist, South America: … more or less five to ten percent of [my] patients reached the neuropsychologist's office.*
Current BCAs are too long for widescale application	*Neurologist, Middle East: Well, I think there are some people that are aware of it [BCA]. But using it is a different thing. Like, when I was in primary care, it's difficult for you to keep using it on every patient to screen them. It's tough for a physician with the short period of time that you have.* *Neurologist, South America: It takes us 20 to 25 minutes. Impossible, in usual practice.*
Current BCAs are either not or poorly validated	*Neurologist, Africa: So, look, we don't have that much normative data. Though, I think there has been a study with [BCA] in [country] from years back by a U.S. group. And so, we have limited normative data, really.* *Neurologist, Asia: That's [normative data] lacking. That's, really, lacking.*
Poor applicability due to language, education, and literacy variables	*Psychiatrist, North America: Well yes, although I think the best thing to improve would be education, in the meantime, we need to serve those with low education. So, we need to have tools that are not biased by education so that we don't confuse who has dementia and who does not. We cannot apply the same test with the same norms to a farmer, an illiterate person, and a doctor in math. I think we need to have specific instruments for each one of them because people that have a lot of intellectual resources are going to mock a test designed for an illiterate person.* *Neurologist, Middle East: The language is different, so that's a challenge. I was trained in the [country]. We used to use [BCAs]. And here in [country], it's tough to translate that in [local language] and try to get all these things together.* *Neurologist, South America: And one of the limitations for us here in [country] is schooling, for example, [BCA 1] is a good test with good schooling, at least 8 years of schooling. Below that, it starts to be a test that can give you false positives. So, it is not a good test for under 4 years, for example, it is very bad. Then it is said that you can give it an extra point. It doesn't help, the patient is still diagnosed with dementia, so one needs to be careful. [BCA 2] is better with regard to education, but it is bad because it does not detect cognitive decline in individuals with more education. It has a low sensitivity in individuals with higher education.*
Poor applicability due to cultural biases	*Neurologist, Asia: I think social conventions would also be a challenge, because we don't react the same, we might not have the same priorities of moral values in mind. That's because of our avocation or the societal cultural beliefs.* *Neurologist, Africa: So, again, some of the photographs and all that in that [stimulus] book, like for facial memory, obviously, they are not at all culturally appropriate. They [face stimuli] are all White. So, that's a downside to that.*
Limited diagnostic accuracy and sensitivity to severity	*Neuropsychologist, Europe: I'm not a fan of short tests screening tests because OK we can have a first glance of the elder, but this distinction between who has SCI and who has late MCI and who has pre-dementia, it's difficult to - to understand it only with short screening tests.* *Geriatrician, Asia: We use [BCA] a lot which has low sensitivity in mild impairment, so we could miss some cases as well.*

Table 4

Domain 3 Needs for Brief Cognitive Assessments (BCAs): themes and exemplary quotes

Themes	Quotes
Better validation studies of BCAs for culturally, linguistically, and educationally diverse groups	*Neurologist, Asia: Get the kind of tools that may be specific and culturally adaptable for the situation of the elderly, especially with low education, and culturally not biased by local language, so we can put in the other area in [country].*
	Geriatrician, South America: Validate it scientifically. For example, the words asked in the test in some countries like [country] could be [word1] or [word2]. Here in [country], they could be other words that represent more common objects; but we could only achieve a scientific validation though [appropriate] adaptation.
BCAs that could be easily administered by non-specialists	*Neuropsychologist, Africa: We also need to realize that because of a lack of specialists we need to develop tools that can actually be administered by less –I don't know if I can say – less qualified people. Oh, for example, tools that don't need to be administered by a neuropsychologist.*
	Neurologist, Europe: In fact, many times, the [BCAs], are administered by the nurse or other heath personnel while the patients are in the waiting room.
Organized infrastructure for standardization and harmonization of BCAs across practices and countries	*Geriatrician, Asia: We also want something which can be comparable with other countries. Therefore, generalizability and comparability are important characteristic I look for in the test. If we want to find a new test, I think we should do it simultaneously and together in multiple centers and internationally, so we can have a test we all can share.*
	Neurologist, Africa: But, obviously, it would be nice to have some kind of, you know, translations or harmonization across other countries and languages. And, obviously, I mean, the words and the objects would have to be something that would be – people would be familiar with.

Table 5

Domain 4 Ideal Brief Cognitive Assessment (BCA): themes and exemplary quotes

Themes	Quotes
Cultural validity and applicability across diverse populations	*Neurologist, Asia: I think one thing that's very important to take into account is education level, and also language proficiencies, or like, you know, occupational complexity, needs to be taken into account for such screening tools.*
	Neurologist, South America: I think we would need to have a simpler test that could be used by a general practitioner. This is an idea that we need to have for all the poorest countries, in fact any country. There should be a set of relatively simple tests with good sensitivity and good specificity for individuals with low education. The ideal would be a test that had little influence by education. So that you could apply the same test without distinction.
	Geriatrician, South America: I think that in [country] the rural population represents around 35 percent of the total population, they have another type of culture, another type of environment, they do other type of activities. So, making an adaptation specifically for rural areas can be a possibility.
Brevity (length < 10 minutes) and ease of administration	*Geriatrician, Asia: I feel it needs to be short for people, both providers and participants, to be willing to do them. I would say around 10–15 minutes. If it can be less than 10 minutes, even better.*
	Neurologist, Africa: If we had a kind of a short, sweet assessment, like a short, sweet questionnaire, that any nurse, or clinical officer, or doctor out there could administer, something that would take, like, 5 minutes, you know, or even less. You know, so, maybe just a couple of questions just to get a history and just a couple of – maybe one or two tests – just to get a feel for whether there's an objective problem. That would be really helpful if it could be rolled out across the public health system as well as the private health system.
Assessment of multiple cognitive domains as well as daily function to assist with differential diagnosis	*Neuropsychologist, Africa: And we don't have any functional tests, as well, apart from cognitive tests. You know, we need to be able to have functional tests.*
	Neurologist, South America: It [BCA] is only dedicated to exploring Alzheimer's disease. So, I lost cases of vascular, frontotemporal, and others … [BCA] tells you, "you have dementia," but not a subtype of dementia.
Sensitivity to early detection of cognitive impairment	*Neurologist, Asia: I think a good screening test that helps to pick up the MCI or very early dementia is one that can be tailored, or that their score can differ for each different category, or that it can encompass all of them. Like, a screening test can pick up MCI in different individuals that have different educational backgrounds – so that's one thing that I would be concerned about.*
	Neuropsychologist, Europe: So, if we are able to collect data from – from typical, normal, cognitively intact elders and see what the normal activity in their daily living is, of course the data can come from sensors. We can create algorithms in which after putting data in we'll be able to understand any differences … we can detect a small difference which could be dementia onset stage.
Potential for technology-assisted administration	*Neuropsychologist, Europe: Oh, technology based. It's easier, it's accessible to anyone who wants to assess from the therapeutic team, yes, it could be technological.*
	Geriatrician, Asia: Many older adults use smartphones these days. However, they are some who struggle to operate these devices. This group, I think, they would need administrators or supervisors to be with them. Computerized tools are said to help with reducing human resources, but if it cannot be self-administered it may not be much different.