Validation of the Brief Assessment of Impaired Cognition and Brief Assessment of Impaired Cognition Questionnaire in a multicultural memory clinic sample across six European countries

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Abstract

Background:

With the changing demographic landscape in most countries worldwide, accurate and brief culture-sensitive case-finding instruments are needed to identify patients with possible cognitive disorders.

Objective:

To investigate the discriminative validity of the Brief Assessment of Impaired Cognition (BASIC) and BASIC Questionnaire (BASIC-Q) in a multicultural memory clinic sample across six European countries.

Methods:

The study was a European cross-sectional multi-center study. Receiver operating characteristic curve analysis was used to examine discriminative validity of BASIC and BASIC-Q in identifying cognitive impairment (mild cognitive impairment (MCI) or dementia) as compared to specialist diagnosis. Regression analysis was used to assess the influence of sociodemographic variables and assessment in a second language on scores.

Results:

The study included a total of 479 participants of which 169 (36%) had immigrant background. BASIC and BASIC-Q had high diagnostic accuracy for cognitive impairment (MCI or dementia) with areas under the curve (AUC) of .93 and .92, respectively. Age had a significant, but small effect on BASIC, while both BASIC and BASIC-Q were unaffected by sex, education, immigrant status, and assessment in a second language. Among patients with affective/anxiety disorder, 80% scored below cutoff for cognitive impairment on BASIC and 94% on BASIC-Q. However, applying an Objective Performance vs. Subjective Complaints ratio to differentiate between patients with cognitive impairment and affective/anxiety disorder resulted in high overall classification accuracies, with AUC values of .80 and .74, respectively.

Conclusions:

The present study suggests that BASIC and BASIC-Q are valid brief case-finding instruments for cognitive impairment in a multicultural setting.

Keywords

Alzheimer's disease, Cognitive Assessment Screening Instrument, Reliability and validity, Cognitive impairments, Dementia, Cultural Sensitivity, Immigrants.

Introduction

The projected increases in demographic aging, migration, and globalization[1], accentuate the need for accurate and brief culture-sensitive case-finding instruments for the identification of patients with possible cognitive disorders in general practice (GP) and other clinical settings. Timely and accurate diagnosis of cognitive disorders is important as it facilitates access to relevant pharmacological and non-pharmacological interventions, counselling, and social community services.[2]

In Europe, more than 6.5 million older people (65+ years) have migrant backgrounds, and of these 475,000 are estimated to have dementia[3] and 690,000 to have mild cognitive impairment (MCI).[4] Differentiating cognitive disorders from normal age-related cognitive decline and affective or anxiety disorders in older people can be highly challenging.[5] These challenges are often exacerbated in culturally and linguistically diverse patients[6, 7], and several studies indicate that dementia and MCI may be underdiagnosed in older, but overdiagnosed in younger, immigrant populations.[8-12] Brief cognitive tests have an essential role in the case-finding of cognitive disorders in the GP setting. However, most routinely used tests, such as the Mini-Mental State Examination (MMSE)[13] and Montreal Cognitive Assessment (MoCA)[14], are known to suffer from cultural, language, and educational biases[15, 16], which limit their usefulness in multicultural clinical contexts. Although more widely applicable cross-cultural tests, such as the Rowland Universal Dementia Assessment Scale (RUDAS)[17], have gained popularity due to decreasing susceptibility to cultural and educational biases[18], the time needed for test administration (10 minutes or more) may be a disadvantage in a busy clinical setting.

The Brief Assessment of Impaired Cognition (BASIC) and BASIC Questionnaire (BASIC-Q) were developed as case-finding instruments for diverse patient populations in the primary care setting.[19, 20] They can both be administered in approximately five minutes[19, 20] and were developed from a

cross-cultural perspective, incorporating tasks with high discriminative validity and low cultural, language, and educational bias.[21-24] BASIC combines self- and informant report with cognitive testing and was primarily intended for use in GP settings[19], whereas BASIC-Q does not include cognitive testing, but rather takes the form of a questionnaire or structured interview for identification of cognitive impairment for use in community settings.[20]

Both instruments have been validated in Mandarin Chinese without the need for any cultural adaptation.[25, 26] In Danish samples, BASIC and BASIC-Q have both demonstrated high discriminative validity for dementia and MCI in a memory clinic setting[19, 20, 27], and for cognitive impairment in a GP setting.[28, 29] However, a more recent study has indicated that the inclusion of a self-report component in BASIC and BASIC-Q makes the instruments relatively sensitive to subjective complaints and thus to affective disorders (Jørgensen et al., unpublished data).

Although BASIC and BASIC-Q were developed from a cross-cultural perspective, their validity as case-finding instruments for cognitive impairment, dementia, and MCI in a multicultural clinical setting has not been established. Therefore, the aim of the present study was to investigate the discriminative validity of BASIC and BASIC-Q in a multicultural memory clinic sample across Denmark, France, Italy, the Netherlands, Spain, and the United Kingdom.

Materials and Methods

The study was a cross-sectional multicenter study carried out in multidisciplinary memory clinics in Copenhagen, Denmark; Granada and Madrid, Spain; London, United Kingdom; Paris, France; Rome and Milan, Italy; and Rotterdam, the Netherlands.

The Brief Assessment of Impaired Cognition (BASIC) and Brief Assessment of Impaired Cognition Questionnaire (BASIC-Q)

BASIC consists of four components: 1) Self-Report, 2) Supermarket Fluency, 3) Category Cued Memory Test (CCMT), and 4) Informant-Report (see Table 1 for an overview. BASIC and BASIC-Q record forms are provided as supplementary materials). BASIC and BASIC-Q contain identical Self- and Informant-Report components, but the two cognitive tests (Supermarket Fluency, CCMT) included in BASIC are substituted with four questions regarding orientation in BASIC-Q. The BASIC total score is obtained by summing the scores of four components into a total score (range 0-25 points), whereas the BASIC-Q total score is obtained by summing the scores of three components into a total score (range 0-20 points). In both instruments, a pro-rated score estimate can be used if a reliable informant report cannot be obtained.

Danish and English versions of the BASIC and BASIC-Q[19, 20] were available at the beginning of the study. For other language versions, the items of BASIC and BASIC-Q were based on available translations of validated instruments[13, 30, 31] or were translated and back-translated from English to the majority language in the collaborating countries (Dutch, French, Italian, and Spanish) by bilingual investigators complying with the neuropsychological application of the TD-1 and TD-2 guidelines of the International Test Commission Guidelines for Translation and Adapting of Tests.[32] No need to change the structure or format of any of the items was encountered during translational procedures.

[INSERT TABLE 1 HERE]

Participants

Participants with European native-born and immigrant backgrounds were included between March 2023 and August 2024. European native-born participants were defined as participants who were born, and typically belonged to a majority ethnic group, in the country of data collection (e.g.,

ethnic Danish in Denmark), while participants with immigrant backgrounds were defined as first generation immigrants or refugees in the country of data collection.

Patients were recruited from secondary care memory clinics in the participating countries. The clinical assessment of patients in the memory services generally included: an interview with the patient and (when possible) an informant; a neurological, physical, and psychiatric examination, including cognitive screening with the MMSE, or RUDAS or other culturally appropriate test in case of cultural, linguistic and/or educational barriers; laboratory screening with blood tests and electrocardiography; and structural brain imaging with computerized tomography or magnetic resonance imaging. Further investigations, including functional imaging with positron emission tomography, cerebrospinal fluid biomarker analysis, and comprehensive psychiatric or neuropsychological evaluation were performed on clinical indication. Diagnoses were provided by a team of experienced clinicians based on evidence from all clinical and investigational results, except the BASIC and BASIC-Q, applying the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders[33] criteria for major neurocognitive disorder (i.e., dementia), and diagnostic research criteria for specific dementia subtypes[34-38], MCI[39], and subjective cognitive decline (SCD).[40] Affective/anxiety disorder (e.g., depression, anxiety, post-traumatic stress disorder) was diagnosed by applying the 10th edition of the International Classification of Diseases criteria.[41] In case patients fulfilled diagnostic criteria for both affective/anxiety disorder and MCI, they were classified as MCI if biomarker results were clearly indicative of early stage AD or another dementia disorder. Otherwise, they were classified with affective/anxiety disorder. Exclusion criteria included severe psychiatric symptoms (e.g., severe depression, psychosis), and a diagnosis other than dementia, MCI, SCD, or affective/anxiety disorder.

Cognitively intact control participants aged 50 years or older were recruited from local GP clinics, community centers, and through the social networks of multicultural and multilingual memory

service clinicians and researchers. Cognitively intact control participants were assessed in their private homes, in the local memory clinic, or in another suitable location, depending on their preference. Exclusion criteria were severe psychiatric or neurological disorder, substance abuse, scoring < 24/30 points on the MMSE or < 23/30 points on the RUDAS, and >5/15 points on the two-step 5/15- item Geriatric Depression Scale (GDS-5/15).[42]

Procedures

All participants underwent an approximately one-hour assessment, in which medical and sociodemographic data were collected and cognitive instruments, including the BASIC and BASIC-Q, were administered. Although assessors were generally blinded to the clinical status of memory service patients, they were not blinded to the status of cognitively intact control participants. All participants were asked about any vision or hearing impairment and were assessed using their hearing aids or prescribed glasses when relevant. Participants with immigrant backgrounds (n = 169) were assessed in their first language by multilingual research assistants or through interpreter-mediated assessment (n = 123), or in a second language when this was their preferred language or interpreters were unavailable (n = 46). The study was approved by the relevant ethics and data protection authorities at each site and adhered to the Declaration of Helsinki for research involving human subjects.

Data analysis

Anonymized participant data from each site were collated in a secure online database (REDCap). All collated data were reviewed by the main author for possible errors, and accuracy of data entry was ensured by reviewing the final collated dataset and by checking outlying data points. For continuous variables, the significance of differences between participants with European native-

born and immigrant status, and between diagnostic groups, was determined using analysis of variance (ANOVA) with pretesting for homogeneity of variances. Welch's ANOVA was used when the assumption of homogeneity of variances was not met. Effect sizes were calculated as η^2. An effect size of < .06 was considered small, .06 to .14 was considered medium, and ≥ .14 was considered large.[43] Fischer's Exact test or Pearson's $\chi 2$-test was used to test the significance of differences in the distribution of categorical variables. When relevant, significant differences were further investigated with Tukey's, Games-Howell's, or Fisher's Exact *post hoc* tests, as appropriate.

To assess diagnostic accuracy, a receiver operating characteristic curve (ROC) was applied to examine the areas under the curve (AUC), sensitivity, specificity, and likelihood ratios of BASIC and BASIC-Q using the consensus diagnosis of cognitive impairment as provided by a team of experienced clinicians as the reference standard. In these analyses, cognitively intact control participants and patients with SCD were pooled to form a cognitively intact group and patients with dementia and MCI were pooled to form a cognitively impaired group, while patients with affective/anxiety disorder were excluded from the analyses. AUC curves were compared using the method proposed by DeLong et al.[44] Cutoff scores for cognitive impairment were based on the originally published cutoff scores for BASIC and BASIC-Q in a memory clinic setting.[19, 20] Optimal cutoff scores for the present sample were further established with the Youden's J statistic. Hierarchical regression analysis with plots of residuals as model control was used to evaluate the effects of education, age, gender, immigrant status, and assessment in a second language on BASIC and BASIC-Q scores in the cognitively intact group. To assess BASIC and BASIC-Q's ability to differentiate the cognitively impaired group from an affective/anxiety disorder group scoring below the cutoff for cognitive impairment, Objective Performance vs. Subjective Complaints (O/S) ratios

were calculated using the method proposed by Jørgensen et al. (unpublished data): BASIC O/S ratio = (Supermarket Fluency + CCMT) / Self-Report; BASIQ-Q O/S ratio = Orientation / Self-Report. Sensitivity, specificity, LR+ and LR– with 95% CI were calculated using the Clinical Calculator 1 from the VassarStats website (www.vassarstats.net/clin1.html). All other analyses were performed with SPSS version 28.0. A p-value < .05 (two-tailed) was considered significant.

Results

Participant characteristics

A total of 479 participants (393 memory clinic patients and 86 cognitively intact control participants) were recruited across the six collaborating countries during the study period: 221 in Italy (148 in Rome and 73 in Milan); 118 in Denmark; 75 in Spain (50 in Madrid and 25 in Granada); 60 in the Netherlands; five in France; and one in the United Kingdom. Ten participants were excluded: six cognitively intact control participants scored below the cutoff for cognitive impairment on the RUDAS, two cognitively intact control participants scored above the cutoff for depression on the GDS-5/15, and two memory clinic patients received a diagnosis other than dementia, MCI, SCD, or affective/anxiety disorder (i.e., metabolic encephalitis and acquired brain injury after resection of meningioma). The 469 included participants represented 49 different countries of origin and 41 different languages. Of 169 participants with immigrant status (36%), 61 originated from a Middle Eastern country, 30 from a Latin American country, 26 from an Asian country, 25 from a North African country, 14 from a sub-Saharan African country, and 13 from a European country. Of 300 participants from European native-born populations, 216 were from Italy, 48 from Spain, and 36 from Denmark. Participants with immigrant status were significantly younger (68.0 ± 8.9 years vs 75.6 ± 9.2 years; $F(1, 466) = 73.75$, $p < .001$, $\eta^2 = .14$) and had fewer years of formal education (8.2 ± 5.3 years vs 9.9 ± 4.8 years; $F(1, 459) = 12.12$, $p < .001$, $\eta^2 = .03$)

compared to European native-born participants, whereas there were no significant differences in sex distribution. Of 188 patients with dementia, 100 were diagnosed with Alzheimer's disease (AD), 23 with vascular dementia (VaD), 25 with mixed AD/VaD, 19 with unspecified dementia, 10 with frontotemporal dementia (FTD), six with dementia with Lewy bodies (DLB)/Parkinson's disease dementia (PDD), two with normal pressure hydrocephalus (NPH), one with HIV-Associated Neurocognitive Disorder, one with progressive supranuclear palsy, and one with dementia due to traumatic brain injury. While BASIC data was available for all participants, data for the Orientation component, and thus BASIC-Q total scores, was missing for 77 memory clinic patients. Sociodemographic and cognitive characteristics stratified by diagnostic group are presented in Table 2.

[INSERT TABLE 2 HERE]

Post hoc tests revealed significant group differences between all groups in BASIC total scores and between all groups in BASIC-Q total scores, except for the affective/anxiety and MCI groups. Effect sizes for comparisons across the four groups were large for both BASIC (η^2 = .57) and BASIC-Q (η^2 = .55).

BASIC and BASIC-Q component scores stratified by diagnostic group are presented in Figure 1. Compared to the other groups, the dementia group scored significantly lower on all components (all $p < .001$) except on Self-Report, where scores were lowest in the affective/anxiety disorder group. Effect sizes for comparisons across the four groups were large for all components (η^2 range .19 - .44).

[INSERT FIGURE 1 HERE]

Diagnostic accuracy

The diagnostic accuracy of BASIC was assessed in 428 participants, including 309 with cognitive impairment (121 with MCI, 188 with dementia) and 119 cognitively intact participants (77 cognitively intact control participants, 42 with SCD). The diagnostic accuracy of BASIC-Q was assessed in 359 participants, including 248 with cognitive disorder (103 with MCI, 145 with dementia) and 111 cognitively intact participants (77 cognitively intact control participants, 34 with SCD).

ROC curves for the BASIC and BASIC-Q are illustrated in Figure 2, and AUC values, cutoff scores, sensitivity, specificity, and likelihood ratios are presented in Table 3. Both BASIC and BASIC-Q had high diagnostic accuracy for differentiating patients with cognitive impairment from cognitively intact participants. Overall, diagnostic accuracy for BASIC did not significantly differ between European native-born and immigrant participants with AUC values of .94 (95% CI, .91 - .98) and .92 (95% CI, .88 - .96), respectively (z = .73, p = .47). The same was true for BASIC-Q, with corresponding AUC values of .93 (95% CI, .89 - .97) and .92 (95% CI, .87 - .97; z = .34, p = .74).

Repeating the analyses in patients with MCI and dementia separately, the AUC values for BASIC were .89 (95% CI = .84 – .93) for separating patients with MCI from cognitively intact participants and .96 (95% CI = .94 – .98) for separating patients with dementia from cognitively intact participants. The AUC values for BASIC-Q were .87 (95% CI = .82 – .92) for MCI and .95 (95% CI = .93 – .98) for dementia.

[INSERT FIGURE 2 HERE]

[INSERT TABLE 3 HERE]

Influence of sociodemographic variables on classification accuracy

When the influence of sociodemographic variables and second language assessment was evaluated with regression analyses in the cognitively intact group, a significant effect of age was found on BASIC, explaining 3% of the variance in scores, whereas BASIC scores were unaffected by sex, education, immigrant status, and assessment in a second language. No significant effects of sociodemographic variables and assessment in a second language were found on BASIC-Q scores (Table 4).

[INSERT TABLE 4 HERE]

Regression analyses for BASIC and BASIC-Q components revealed significant effects of education (p = .002) and immigrant status (p = .01) on Supermarket Fluency, explaining 14% and 5% of the variance in scores, respectively, and of education (p = .003) on Orientation, explaining 10% of the variance in scores. The other BASIC and BASIC-Q components were unaffected by sociodemographic variables and assessment in a second language (see Supplementary Tables 1-5).

Differentiation of cognitive impairment from affective/anxiety disorder

The proportion of patients scoring below the original cutoff for cognitive impairment on BASIC (<20/25 points) was 93% in the cognitive impairment group and 80% in the affective/anxiety disorder group, while the proportion of patients scoring below the original cutoff for cognitive impairment on BASIC-Q (<17/20 points) was 93% in the cognitive impairment group and 94% in the affective/anxiety disorder group. Among patients in the cognitive impairment and

affective/anxiety disorder groups who scored below cutoff for cognitive impairment on BASIC (n = 318), the BASIC O/S ratio was significantly higher in the affective/anxiety disorder group (mean 6.68 ± 3.65) compared to the cognitive impairment group (mean 3.14 ± 2.83; *Welch' s F* (1, 35.29) = 28.21, $p < .001$, $\eta^2 = .12$). Likewise, among patients scoring below cutoff on BASIC-Q (n = 261), the BASIC-Q O/S ratio score was significantly higher in the affective/anxiety disorder group (mean 4.16 ± 2.40) compared to the cognitive impairment group (mean 2.29 ± 2.15; $F(1, 259) = 20.16$, $p < .001$, $\eta^2 = .07$). O/S ratio AUC values, optimal cutoff scores, and classification accuracies for differentiating cognitive impairment from affective/anxiety disorder among patients scoring below cutoff on BASIC and BASIC-Q are presented in Table 5.

[INSERT TABLE 5 HERE]

Discussion

In this study, the discriminative validity of BASIC and BASIC-Q was investigated in a multicultural memory clinic sample across six European countries. We found that BASIC and BASIC-Q could discriminate between patients with cognitive impairment and cognitively intact participants with high accuracy, with AUC values of .93 and .92 for BASIC and BASIC-Q across the whole sample, .94 and .92 in European native-born and .93 and .92 in immigrant participants analyzed separately, and .89 and .87 in a subsample with MCI, and .96 and .95 in a subsample with dementia. These values are comparable to those reported in previous validation studies in monocultural memory clinic and GP clinic samples in Denmark, which report AUC values in the range of .88 – .99 for BASIC[19, 27, 29] and .84 - .98 for BASIC-Q.[20, 27, 28]

Both the primary validation in memory clinics [19, 20] and cross-validation studies in GP clinics[28, 29] suggest a cutoff score of <20/25 for BASIC and <17/20 for BASIC-Q to be optimal for

differentiating patients with cognitive impairment from cognitively intact controls. Applying these cutoff scores resulted in high sensitivity and moderate specificity of both BASIC and BASIC-Q. However, the present study finds optimal cutoff scores of <18/25 for BASIC and <16/20 for BASIC-Q in a multicultural memory clinic setting, with a sensitivity of .84 and a specificity of .87 for BASIC, and a sensitivity of .87 and a specificity of .81 for BASIC-Q. Variations across studies may largely reflect differences in sample characteristics, including age- and educational ranges, adopted control groups (i.e., cognitively intact control participants vs cognitively intact control participants pooled with patients with SCD), and patient characteristics (e.g., degree of cognitive impairment and heterogeneity of specific dementia disorders). Importantly, the inclusion of patients with SCD in the control group may explain the moderate specificity when applying the original cutoff scores and the lower optimal cutoff scores in the present study.

In this study, BASIC and BASIC-Q total scores were unaffected by sex, education, immigrant status, and assessment in a second language, while age had a statistically significant but numerically small effect on BASIC scores. Analyses of BASIC and BASIC-Q components revealed statistically significant, but numerically small, effects of education and immigrant status on Supermarket Fluency, and of education on Orientation. In line with previous research[45], Self- and Informant Report were unaffected by immigrant status and assessment in a second language, providing further support for the cross-cultural validity of self- and informant reported measures. Taken together, this supports previous findings, suggesting BASIC and BASIC-Q to be relatively unbiased by cultural and linguistic factors[25] and that the effect of education is negligible.[19, 20, 26]

In the present study, we specifically included patients with affective/anxiety disorder to further examine the influence of affective symptoms on BASIC and BASIC-Q. Analysis of the components of BASIC and BASIC-Q revealed an important difference in the profiles of the dementia and affective/anxiety disorder groups. Whereas the dementia group had moderately low Self-report

scores and displayed severely impaired performances on objective cognitive measures, the affective/anxiety disorder group had very low Self-report scores despite relatively less impaired performance on objective cognitive measures. A substantial proportion of patients with affective/anxiety disorder scored below the cutoff for cognitive impairment on both BASIC (80%) and BASIC-Q (94%), supporting the suggestion that the inclusion of self-report makes the instruments susceptible to subjective complaints and thus to affective symptoms[47]. The concept of an O/S (Objective Performance vs. Subjective Complaints) ratio score to help differentiate between cognitive and affective/anxiety disorder among patients scoring below cutoff on BASIC and BASIC-Q has previously been proposed by Jørgensen et al. (unpublished data). Among patients scoring below the cutoff for cognitive impairment, a BASIC O/S ratio cutoff score of > 3.17 correctly classified 81% of the patients with affective/anxiety disorder, and a BASIC-Q O/S ratio cutoff score of > 2.33 correctly classified 74% of these patients. These cutoff scores and classification rates are generally in line with those previously reported (Jørgensen et al., unpublished data), supporting the cross-cultural utility of the O/S ratio score to identify patients to be considered for further evaluation of affective/anxiety symptoms among those scoring below the cutoff for cognitive impairment.

Among the strengths of the study is the inclusion of a relatively large multicultural sample, representing several European native-born and immigrant populations with both intact cognition, cognitive impairment, and affective/anxiety disorder. Also, the inclusion of patients with SCD in the cognitively intact comparison group seems to reflect the intended context and setting of use (e.g., case-finding among patients with subjective memory complaints in GP clinics or other clinical settings). Recruitment across multiple sites means that findings may be generalized across countries, although the inclusion of only five participants in France and one in the UK is a

restriction. Some limitations of the study should also be considered. As this was a cross-sectional study with no follow-up, there is the possibility of some misclassification of both patients with cognitive and affective/anxiety disorders, and cognitively intact control participants. Also, although patients were classified using well-established diagnostic criteria, these criteria may have been operationalized differently across sites. Especially in the case of participants with immigrant status, this may be a limitation as there is no gold standard for cross-cultural assessment and diagnosis of cognitive and affective/anxiety disorders.[46-48] However, the RUDAS was a principal part of the standard diagnostic assessment of culturally and linguistically diverse patients in the participating memory clinics, and diagnoses were based on a comprehensive assessment and the consensus of a team of experienced clinicians. Another limitation was the age differences between diagnostic groups, with younger age in the affective/anxiety disorder group and older age in the dementia group compared to the other groups. Additionally, there was a different distribution of participants with immigrant status between diagnostic groups, with proportionally fewer patients with MCI and dementia among patients with immigrant status. Also, differences in age and education between European native-born and immigrant participants, with younger age and lower education among immigrant participants, may have influenced the results. However, these distributions seem to reflect the clinical reality in Europe, where immigrants from low- and middle-income countries presenting to memory clinics often have lower socioeconomic status, are younger, and are less likely to be diagnosed with dementia compared to their European native-born counterparts.[46, 49, 50] Finally, the patient sample may be representative for patients referred to memory clinics, but not for a GP or primary care setting. Although the discriminative validity of BASIC and BASIC-Q has been established in these settings[28, 29], future studies are needed to confirm the cross-cultural validity of BASIC and BASIC-Q in GP and primary care settings.

In conclusion, with increasing cultural and linguistic diversity in older populations worldwide, culture-sensitive, and accurate identification of patients with possible cognitive disorders in GP and other clinical settings becomes increasingly important. The present study suggests that BASIC and BASIC-Q are valid brief case-finding instruments for cognitive impairment in multicultural settings. The instruments appear to have high discriminative validity for identifying cognitive impairment, dementia, and MCI in patients referred for diagnostic evaluation in a memory clinic, while being relatively robust to cultural, language, and educational bias. The study also provides evidence for the validity and clinical applicability of using the O/S ratio as a clinical marker of affective symptoms in this setting. While the O/S ratio cannot be used to rule out cognitive impairment, it offers a structured, evidence-based, approach to identify patients to be considered for further evaluation of affective symptoms among those scoring below cutoff for cognitive impairment on BASIC or BASIC-Q. This may be particularly important in a GP setting, as further clinical evaluation and management is fundamentally different for cognitive compared to affective/anxiety disorders. While both instruments may be effective tools for identifying patients for whom further diagnostic assessment should be considered, it is important to note that neither BASIC nor BASIC-Q are diagnostic instruments and should not be used as such. Neither instrument can substitute expert clinical evaluation. In future research, it will be interesting to further explore the clinical utility of BASIC and BASIC-Q in multicultural settings, and to perform head-to-head comparisons with the accuracy of other more widely used cross-cultural cognitive instruments.

Author Contributions Statement

T. Rune Nielsen (Conceptualization; Methodology; Formal Analysis; Writing - Original draft preparation; Project administration); Kasper Jørgensen (Conceptualization; Methodology; Writing - Review & Editing); Marco Canevelli (Investigation; Data curation; Writing - Review & Editing);

Simone Pomati (Investigation; Data curation; Writing - Review & Editing); Alfonso Delgado Alvarez (Investigation; Data curation; Writing - Review & Editing); Sanne Franzen (Investigation; Data curation; Writing - Review & Editing); Alvaro Lozano-Ruiz (Investigation; Data curation; Writing - Review & Editing); Maria Özden (Investigation; Writing - Review & Editing); Juliette Palisson (Investigation; Data curation; Writing - Review & Editing); Naaheed Mukadam (Investigation; Data curation; Writing - Review & Editing); Gunhild Waldemar (Supervision; Writing - Review & Editing).

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Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

The data supporting the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Table 1. Brief Assessment of Impaired Cognition and Brief Assessment of Impaired Cognition Questionnaire

BASIC	Score Range	BASIC-Q	Score Range
1. Self-Report Three questions from CFI regarding self-rated memory functioning	0-6	1. Self-Report Items identical to BASIC	0-6
2. Supermarket Fluency With an interval scoring algorithm	0-5	2. Orientation Orientation in time (year, month, day of week) and orientation in person (age)	0-8
3. CCMT Free and category cued recall of four color pictures	0-8		
4. Informant Report Three questions from IQCODE regarding cognitive functioning of the patient	0-6	3. Informant Report Items identical to BASIC	0-6
BASIC Total Score	0-25	BASIC-Q Total Score	0-20

Abbreviations: BASIC = Brief Assessment of Impaired Cognition; BASIC-Q = Brief Assessment of Impaired Cognition Questionnaire; CFI = Cognitive Function Instrument; CCMT = Category Cued Memory Test; IQCODE = Informant Questionnaire of Cognitive Decline in the Elderly

Table 2. Sociodemographic and cognitive characteristics

Characteristic	Control (G1)		SCD (G2)		Affective/anxiety (G3)		MCI (G4)		Dementia (G5)		*p*	Group differences[#]
	Mean	(SD) [Range]	Mean	(SD) [Range]	Mean	(SD) [Range]	Mean	(SD) [Range]	Mean	(SD) [Range]		
n	78		42		40		121		188			
Age (years)	68.63	(9.66) [50-86]	68.93	(8.59) [51-87]	62.20	(11.21) [28-85]	73.60	(8.55) [49-89]	77.29	(7.51) [57-94]	<.001	G3<G1;G2<G4;G5
Sex (n, male/female)	35 / 43		23 / 19		18 / 22		64 / 57		81 / 107		.40	
Education (years)	9.44	(5.81) [0-20]	9.00	(4.86) [0-19]	10.16	(4.73) [0-17]	10.66	(4.70) [0-18]	9.33	(5.06) [0-20]	.002	G3;G4>G5
Immigrant status (n)	39		27		30		24		49		<.001	G2;G3>G1>G4;G5
Years in receiving country	38.89	(12.33) [9-54]	39.59	(11.14) [21-57]	35.93	(13.04) [8-62]	39.39	11.18	40.85	(11.66) [20-60]	.31	
Assessed in 2nd language	6		10		13		5		12		.07	
MMSE/RUDAS	27.53	(1.87) [23-30]	26.74	(2.60) [20-30]	26.03	(2.45) [21-30]	24.12	(4.18) [15-30]	18.53	(5.47) [2-28]	< .001	G1;G2;G3>G4>G5
GDS-5/15[†]	.52	(1.00) [0-4]	1.01	(2.04) [0-7]	8.06	(4.00) [0-14]	1.36	(2.88) [0-14]	2.18	(3.30) [0-15]	< .001	G1<G5<G3

BASIC (range 0-25)	22.58	(2.38) [16-25]	19.05	(3.72) [10-25]	16.35	(3.82) [6-25]	14.84	(4.48) [4-23]	10.51	(4.66) [0-21]	<.001	G1>G2>G3 >G4>G5
BASIC-Q (range 0-20)	18.40	(1.76) [14-20]	15.44	(3.19) [3-20]	12.12	(3.36) [5-17]	12.74	(3.77) [3-20]	9.02	(4.13) [0-19]	<.001	G1>G2>G3; G4>G5

Abbreviations: SCD = subjective cognitive decline; MCI = mild cognitive impairment; SD = standard deviation; BASIC = Brief Assessment of Impaired Cognition; BASIC-Q = Brief Assessment of Impaired Cognition Questionnaire.

[#] Based on post-hoc comparisons.

[†] n = 235

Table 3. Diagnostic accuracy of the BASIC and BASIC-Q for cognitive impairment

	AUC (95% CI)	Cutoff	Sensitivity (95% CI)	Specificity (95% CI)	LR+ (95% CI)	LR- (95% CI)
BASIC	.93 (.91 - .96)	<20/25[#]	.92 (.89 - .95)	.77 (.67 - .84)	3.93 (2.84 - 5.45)	.10 (.07 - .14)
		<18/25[†]	.84 (.79 – .88)	.87 (.80 - .93)	6.68 (4.15 - 10.74)	.18 (.14 - .24)
BASIC-Q	.92 (.89 - .95)	<17/20[#]	.93 (.89 - .96)	.71 (.62 - .79)	3.23 (2.40 - 4.32)	.10 (.06 - .16)
		<16/20[†]	.87 (.82 - .91)	.81 (.72 - .88)	4.58 (3.11 - 6.76)	.16 (.12 - .23)

Abbreviations: BASIC = Brief Assessment of Impaired Cognition; BASIC-Q = Brief Assessment of Impaired Cognition Questionnaire; AUC = area under the curve; CI = confidence interval; LR+ = positive likelihood ratio; LR- = negative likelihood ratio.

Note: The table presents diagnostic accuracy for separating groups of participants with cognitive impairment (dementia and dementia and mild cognitive impairment) from cognitively intact participants (cognitively intact control and subjective cognitive decline).

[#] Originally published cutoff score.

[†] Optimal cutoff score in the present sample based on Youden's *J*.

Table 4. Hierarchical regression analysis: effect of sociodemographic variables and assessment in 2nd language on BASIC and BASIC-Q scores

	BASIC (n = 120)				BASIC-Q (n = 111)			
Variable	***B***	***SEB***	***t***	***p***	***B***	***SEB***	***t***	***p***
(Constant)	27.38	3.46	7.92	<.001	21.52	2.93	7.35	<.001
Age	-.08	.04	-2.36	.02	-.05	.03	-1.60	.11
Sex	.67	.62	1.09	.28	.29	.51	.57	.57
Education (years)	.08	.06	1.29	.20	.07	.05	1.36	.18
Immigrant status	-1.08	.76	-1.42	.16	-.57	.64	-.89	.37
Assessed in 2nd language	-.34	1.00	-.33	.74	-.82	.81	-1.01	.32

Abbreviations: BASIC = Brief Assessment of Impaired Cognition; BASIC-Q = Brief Assessment of Impaired Cognition Questionnaire; *SEB* = standard error of *B.*

Table 5. Differentiation of cognitive impairment from affective/anxiety disorder among patient scoring below cutoff on BASIC and BASIC-Q

	AUC (95% CI)	Cutoff	Affective/anxiety classified correctly	Cognitive impairment classified correctly
BASIC O/S ratio	.80 (.72 - .87)	> 3.17 / ≤ 3.17	81%	65%
BASIC-Q O/S ratio	.74 (.65 - .82)	> 2.33 / ≤ 2.33	74%	66%

Abbreviations: BASIC = Brief Assessment of Impaired Cognition; BASIC-Q = Brief Assessment of Impaired Cognition Questionnaire; AUC = area under the curve; CI = confidence interval; O/S = Objective Performance vs. Subjective Complaints.

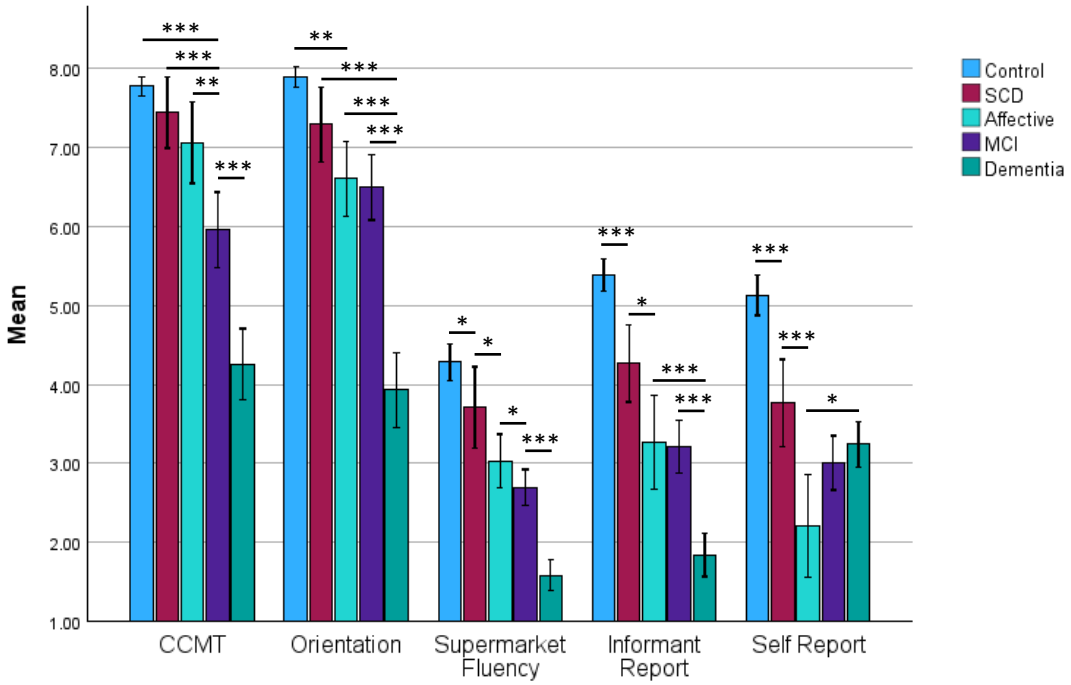

Figure 1. BASIC and BASIC-Q component scores

Abbreviations: SCD = subjective cognitive decline, MCI = mild cognitive impairment, CCMT = Category Cued Memory Test. Error bars represent ± 2 standard errors.

Note: Group differences based on post-hoc comparisons using the control group as reference.

* p < .05; ** p < .01; *** p < .001.

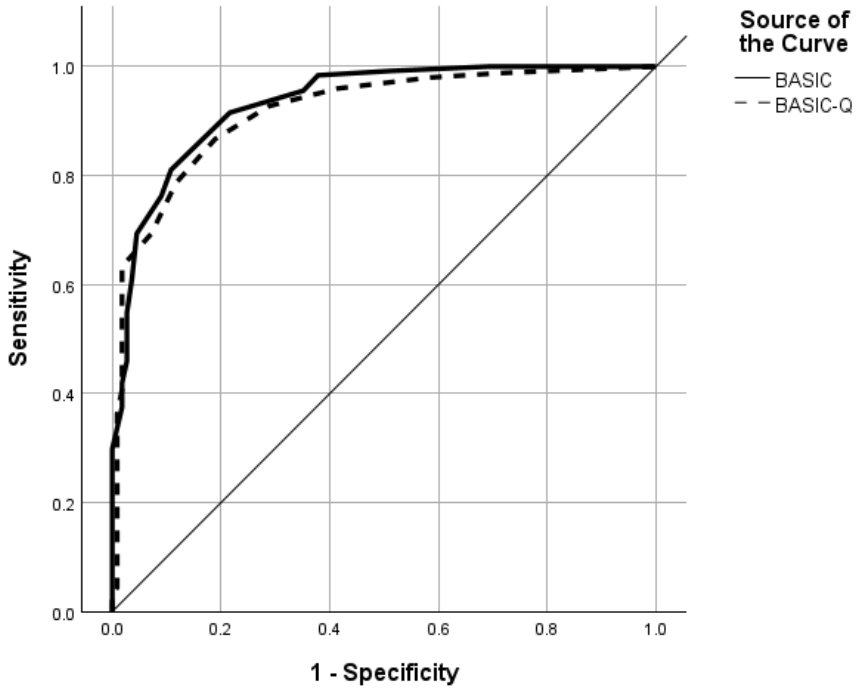

Figure 2. Receiver operating characteristics (ROC) curve for BASIC and BASIC-Q for detecting cognitive impairment

Note: The figure depicts diagnostic accuracy for separating groups of participants with cognitive impairment (dementia and mild cognitive impairment) from cognitively intact participants (cognitively intact control and subjective cognitive decline).