Received: 19 December 2023 | Revised: 17 March 2024 | Accepted: 4 May 2024

DOI: 10.1111/jgs.19020

BRIEF REPORT

Journal of the American Geriatrics Society

A cross-cultural study of the Montreal Cognitive Assessment for people with hearing impairment

Stacey Theocharous MClinNeuro[1] | **Greg Savage PhD**[1] | **Anna Pavlina Charalambous PhD**[2] | **Mathieu Côté MD**[3] | **Renaud David MD**[4] | **Kathleen Gallant PhD**[5] | **Catherine Helmer MD**[6] | **Robert Laforce MD, PhD**[7] | **Iracema Leroi MD, PhD**[8] | **Ralph N. Martins PhD**[9,10] | **Ziad Nasreddine MD**[5] | **Antonis Politis MD, PhD**[11] | **David Reeves Bsc, PhD**[12] | **Gregor Russell MD**[13] | **Marie-Josée Sirois PhD**[14] | **Hamid R. Sohrabi PhD**[15] | **Chyrssoula Thodi PhD**[2] | **Christiane Völter MD, PhD**[16] | **Wai Kent Yeung PhD**[12] | **Piers Dawes PhD**[17,18]

[1]Centre for Ageing, Cognition, and Wellbeing, School of Psychological Sciences, Macquarie University, Macquarie Park, New South Wales, Australia

[2]European University, Nicosia, Cyprus

[3]Department of Otorhinolaryngology, Head and Neck Surgery, CHU de Québec-Université Laval, Québec, Québec, Canada

[4]Centre Hospitalier Universitaire de Nice, Nice, France

[5]MoCA Clinic & Institute, Québec, Québec, Canada

[6]INSERM, Bordeaux Population Health Research Center, UMR U1219, University of Bordeaux, Bordeaux, France

[7]Clinique Interdisciplinaire de la Mémoire, CHU de Québec, Université Laval, Québec, Québec, Canada

[8]Global Brain Health Institute, Trinity College Dublin, Dublin, Ireland

[9]School of Medical and Health Sciences, Edith Cowan University, Joondalup, Western Australia, Australia

[10]Macquarie Medical School, Macquarie University, Macquarie Park, New South Wales, Australia

[11]Division of Geriatric Psychiatry, 1st Department of Psychiatry, Eginition Hospital, National and Kapodistrian University of Athens, Athens, Greece

[12]Faculty of Biology, Medicine and Health, Centre for Biostatistics, School of Health Sciences, The University of Manchester, Manchester, UK

[13]Bradford District Care NHS Foundation Trust, Bradford, UK

[14]Department of Rehabilitation, Faculty of Medicine, Université Laval, Québec, Québec, Canada

[15]Centre for Healthy Ageing, College of Science, Health, Engineering and Education (SHEE), Murdoch University, Murdoch, Western Australia, Australia

[16]Department of Otorhinolaryngology, Head and Neck Surgery, Catholic Hospital Bochum, Bochum, Germany

[17]University of Queensland Centre for Hearing Research (CHEAR), School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Queensland, Australia

[18]Manchester Centre for Audiology and Deafness, The University of Manchester, Manchester, UK

Correspondence
Piers Dawes, University of Queensland Centre for Hearing Research (CHEAR), School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Qld, Australia.
Email: p.dawes@uq.edu.au

Abstract

Background: Cognitive screening tools enable the detection of cognitive impairment, facilitate timely intervention, inform clinical care, and allow long-term planning. The Montreal Cognitive Assessment for people with hearing impairment (MoCA-H) was developed as a reliable cognitive screening tool for

Funding information
NIHR Manchester Biomedical Research Centre, Grant/Award Number: BRC-1215-20007; Horizon 2020 Framework Programme, Grant/Award Number: 668648

people with hearing loss. Using the same methodology across four languages, this study examined whether cultural or linguistic factors affect the performance of the MoCA-H.

Methods: The current study investigated the performance of the MoCA-H across English, German, French, and Greek language groups ($n = 385$) controlling for demographic factors known to affect the performance of the MoCA-H.

Results: In a multiple regression model accounting for age, sex, and education, cultural–linguistic group accounted for 6.89% of variance in the total MoCA-H score. Differences between languages in mean score of up to 2.6 points were observed.

Conclusions: Cultural or linguistic factors have a clinically significant impact on the performance of the MoCA-H such that optimal performance cut points for identification of cognitive impairment derived in English-speaking populations are likely inappropriate for use in non-English speaking populations. To ensure reliable identification of cognitive impairment, it is essential that locally appropriate performance cut points are established for each translation of the MoCA-H.

KEYWORDS

cognitive testing, cross-cultural comparison, hearing impaired persons, mental status and dementia tests, transcultural study, validity and reliability

INTRODUCTION

Cognitive screening tests are commonly used in healthcare settings to identify possible cognitive impairments, facilitating appropriate planning, care, and early intervention.[1,2] There are well-documented cultural influences on cognitive assessments, with factors including shared knowledge, beliefs, and behaviors impacting the performance of tests of attention, memory, and executive function.[3] Translation alone does not adequately account for performance differences, which may be a result of cultural differences.[4]

The freely available Montreal Cognitive Assessment (MoCA)[5] is one of the most widely used cognitive screening tools. The 10-min long MoCA examines visuospatial/executive function skills, naming, language, attention, word recall, and orientation, with a total score of 30 points.[5,6] A key limitation of the MoCA and similar cognitive screening tests is that they are administered through spoken form and rely on test-takers having good hearing; up to 70% of adults aged over 60 years have hearing impairment.[7] Poor performance on a cognitive screening test due to the impact of hearing impairment may result in misdiagnosis or overestimation of cognitive impairment.[8] Dawes and colleagues therefore developed and validated a visually based version of the MoCA for English-speaking people with hearing impairment: the MoCA-H.[9] The standard MoCA has been translated into over 100 languages. A systematic review of the cross-

Key points

- A cross-cultural investigation of a cognitive screening tool developed for hearing impaired people showed that there are significant differences in performance between English and French, Greek, and German versions, beyond controlling for age, sex, and education.
- Differences could be explained by cross-cultural differences given that the same protocol was used for data collection across language groups.
- Cutoff scores may vary across language versions of the MoCA-H and clinical decisions should be made with caution.

Why does this paper matter?

Given that decreased audibility is associated with misdiagnosis and overestimation of cognitive impairment, it is important to develop cognitive screening tools for hearing impaired individuals. Another factor to consider is the cross-cultural applicability of cognitive screening tools. Understanding cultural and linguistic differences in the performance of a recently developed cognitive screening tool for hearing impaired individuals is important to evaluate its clinical utility.

cultural performance of the MoCA examined 34 studies across 14 languages[10] and reported a wide range of cutoffs for cognitive impairment across languages, with variability in sensitivity and specificity. The study concluded that there were performance differences between languages, but that it was uncertain whether these differences were attributable to methodological differences between studies or to cultural/linguistic factors. Previous studies have examined the performance of the standard MoCA in French-, Greek-, and German-speaking populations.[11–13] These studies all reported different optimal cut points for cognitive impairment.

To our knowledge, the current study is the first to compare performance on a version of the MoCA across several cultural–linguistic groups using the same research protocol, making it possible to disentangle methodological and cultural factors. We used multiple regression modeling to control for known effects of educational level, sex, and age on MoCA-H performance.

METHODS

The original MoCA-H development studies employed a case–control (dementia vs normal cognition) design across sites in Australia, the United Kingdom (both comprising the "English" sample), France, Greece, Cyprus (the "Greek" sample), and Germany. The current study utilized those participants with normal cognition only. Participants were recruited from audiology services, volunteer databases, and the community. To be included, participants must have been aged over 60 years, with clinically significant hearing impairment, resident in the general community, and have the capacity to provide written informed consent to participate. Those living in long-term care facilities, who did not understand written and spoken language, had dual sensory impairment (both hearing and vision impairment), who were culturally Deaf (i.e., identifying with Deaf community and values, whereby sign language may be the primary mode of communication), or who had a cognitive impairment were excluded.

Hearing impairment status was established on pure-tone air conduction threshold testing. Hearing impairment was defined as a better-ear audiometric threshold ≥40 dB HL over 1, 2, and 4 kHz. Pure tone audiometric hearing assessment was carried out in a "quiet room" with a R07A Screening Portable Audiometer (Kamplex Limited, London), using audiocup headphones (Amplivox, Eden Prairie MN) to minimize background noise. Before hearing testing, background noise levels were measured with a KM6 Sound level meter (Kamplex Limited, London) to ensure noise levels were below those recommended by American National Standards Institute standards.[14] Those who reported fluctuating or recent changes in hearing or visual acuity with presenting visual acuity poorer than <6/12 were excluded. All participants completed a demographics questionnaire and the GPCog, a gold standard screening instrument for dementia developed for primary care settings, which screens orientation, recalls, and collects self- and informant-reported information about cognitive status.[15] Healthy cognitive status was established based on GPCog performance (receiving the maximum score of 9 indicates no cognitive impairment) and no clinician or self-reported doctor diagnosis of dementia or cognitive impairment.

The study was reviewed and ethical approval granted by the National Health Service Health Research Authority Greater Manchester West Research Ethics Committee (UK; 17/NW/0494), the Cyprus National Bioethics Committee (EEBK/Eπ/2016/29), the Comité de Protection des Personnes du Sud-Ouest et Outre-Mer IV (DC 2016/80), Université Laval Research Ethics Committee (MP-20-2020-4589), the Local Ethical Committee of Health Sciences and Scientific Committee of the Eginition Hospital of the National and Kapodistrian University of Athens (Z5E4648N2-FT4), and Macquarie University Human Research Ethics Committee (52022947943893).

MoCA—hearing impaired version

Instructions and stimuli were presented in written format rather than spoken format. The MoCA-H has a reported sensitivity and specificity of 92.8% and 90.8%, respectively, for dementia at a cutoff score of 24,[9] though we note that these metrics (as well as those for the standard MoCA[5]) are potentially inflated due to the case–control design of validation studies favoring the inclusion of cases of dementia that are more severe than is typical of the underlying population.[16] The total MoCA-H score is 30, including a 2-point adjustment for 12 or less years of education,[9] with seven sub-domains (visuospatial/executive, naming, attention, language, abstraction, memory, and orientation) as in the standard MoCA. The English MoCA-H was translated into French, Greek, and German by Dawes and colleagues[17] and Völter and colleagues[18] using Cha, Kim, and Erlen's method[19] for translating standardized assessments.

Consent and testing procedures

Testing took place at participants' homes or testing rooms within research facilities. Capacity to consent was formally assessed, and written informed consent was obtained.

All researchers had training in assessing capacity according to relevant local laws, as well as training in the administration of the MoCA-H. After providing consent, participants completed a hearing and vision assessment, followed by the demographic questionnaire and the MoCA-H.

Data analysis

Post hoc power was calculated using G*Power version 3.1.[20] The sample size obtained ($n = 385$) provided adequate statistical power at the 0.05 level of statistical significance and detected a small effect size ($d = 0.2$) in a linear multiple regression model. Analyses were conducted using Stata Version 17. Data were cleaned and variables were visually analyzed on a histogram to characterize normality of distributions and to check for outliers. Analysis of variance (ANOVA) models were used to test for demographic and MoCA-H performance differences between language groups. A two-step hierarchical linear regression was conducted, initially for the MoCA-H total score, and subsequently for each domain (visuospatial/executive, naming, memory, attention, language, abstraction, and orientation), controlling for factors known to impact MoCA performance including age, sex, and education which were entered into the first step, with the predictor MoCA-H language entered into Step 2 where the English group was used as the reference group.

RESULTS

Across sites, 391 participants were identified with normal cognition. A total of 6 participants had invalid scores or missing data; results are based on the analytical sample of 385. Descriptive statistics for age, sex, and education are presented in Table 1.

A one-way ANOVA indicated differences in age between groups, $F(3, 384) = 26.26$, $p < 0.001$. Post hoc pairwise comparisons indicated that the average age was significantly higher in the French group than in the English group, $F(1, 384) = 7.48$, $p < 0.001$, Greek group, $F(1, 384) = 7.67$, $p < 0.001$, and German group, $F(1, 384) = 10.87$, $p < 0.001$. The average age was significantly lower in the German group compared to the English group $F(1, 384) = 3.39$, $p < 0.05$ and Greek group $F(1, 384) = 3.20$, $p < 0.05$. The proportion of those with less than 12 years education was different between groups, X^2 (3, $n = 385$) = 13.53, $p < 0.05$; there were no differences in the proportions of males and females, X^2 (3, $n = 385$) = 3.21, $p > 0.05$.

MoCA-H total score

The MoCA-H total as a function of MoCA-H language is presented in Figure 1. A one-way ANOVA indicated differences in MoCA-H total between groups, $F(3, 384) = 18.24$, $p < 0.001$. Post hoc pairwise comparisons indicated that the average MoCA-H total was significantly higher in the English group than in the French group, $F(1, 384) = 4.30$, $p < 0.001$, Greek group, $F(1, 384) = 3.42$, $p < 0.001$, and German group, $F(1, 384) = 2.5$, $p < 0.001$. The average MoCA-H total was significantly higher in the German group compared to the French group $F(1, 384) = 1.80$, $p < 0.05$. There were no differences in the MoCA-H total between the German and Greek groups $F(1, 384) = 0.92$, $p > 0.05$ and the Greek and French groups $F(1, 384) = 0.87$, $p > 0.05$.

Age, sex, and education explained 26.76% of the variability in the MoCA-H total score, and adding language to the model explained a further 6.89% of the variability in the MoCA-H total score (Table 2). After controlling for other predictors, compared with English participants, the MoCA-H total score was on average 2.64 points lower for French participants, 2.82 points lower for Greek participants, and 2.54 points lower for German participants. With the exception of the orientation domain (where all groups scored close to ceiling levels), language explained between 3% and 10% of variance across individual of MoCA-H domains (see Supplementary Table S1).

DISCUSSION

Prior reviews identified differences in MoCA performance across languages, although it was unclear to what

TABLE 1 Descriptive statistics for participant demographics.

	English	French	Greek	German	Total
N	70	61	79	175	385
Age (years, M (SD))	74.91 (7.93)	82.39 (7.40)	74.72 (7.98)	71.52 (8.77)	74.51 (8.77)
Sex (% male)	44.29	54.10	55.70	56.57	53.77
Education (% less than 12 years)	40.00	68.85	63.29	53.14	55.32

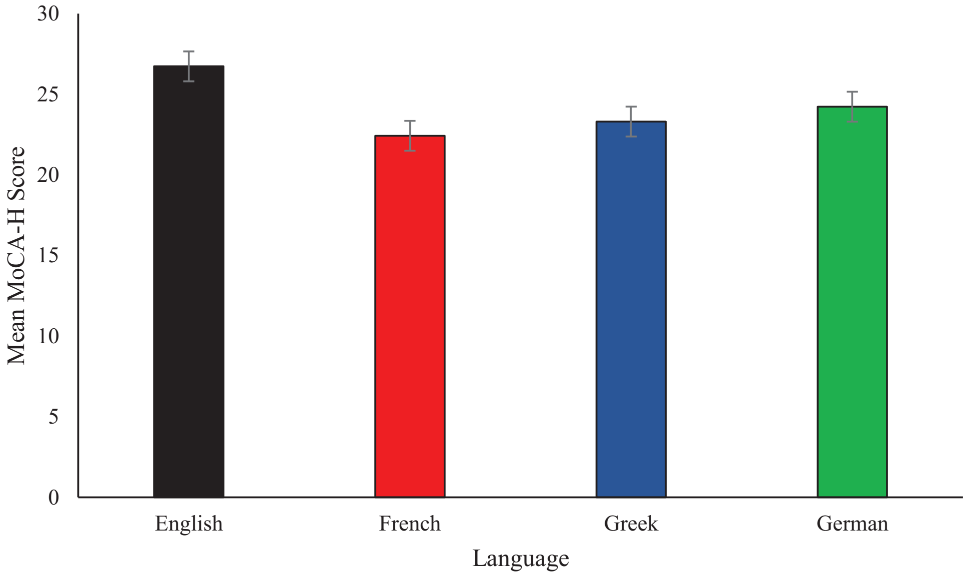

FIGURE 1 MoCA-H total score as a function of language. Error bars show standard deviations.

TABLE 2 Hierarchical regression analysis for variables predicting MoCA-H total score ($n = 385$).

Variable		b	t	sr^2	R	R^2	ΔR^2
Step 1					0.52	0.27	0.27*
	Age	−0.12*	−6	0.07			
	Sex	0.53	1.55	0.00			
	Education	2.90*	8.27	0.13			
Step 2					0.58	0.34	0.07*
	Age	−0.12*	−6.01	0.06			
	Sex	0.30	0.92	0.00			
	Education	2.53*	7.44	0.10			
	MoCA-H language						
	French	−2.64*	−4.61	0.05			
	Greek	−2.82*	−5.40	0.07			
	German	−2.54*	−5.58	0.08			

Note: b, unstandardized regression coefficient; sr^2, semi-partial correlation squared; ΔR^2, R-squared change. Significance at the 0.05 level is denoted by *.

extent these differences were attributable to methodological or linguistic/cultural differences between studies.[10] Using the same methodology across four languages and controlling for demographic factors known to impact performance, we found differences in MoCA-H performance, which may be attributed to cultural or linguistic factors. The size of the difference was of sufficient size to be clinically significant, and the result implies that performance criteria derived from English samples may not be applicable for versions of the MoCA-H in other languages. Some MoCA-H items may need to be adapted in line with recommendations to ensure that translations and cultural adaptions are robust[6] to maintain conceptual equivalence when translated into other languages.

There were no adaptations beyond translation to items in the French, Greek, or German MoCA-H (C. Helmer, personal communication, April 12, 2023; C. Thodi, personal communication, April 5, 2023; and C. Völter, personal communication, April 14, 2023). The current study revealed differences in MoCA-H subdomains, which may suggest that cultural adaptation would be appropriate for even nonverbal tasks. Different patterns of abilities and cognitive styles arise from one's cultural and ecological environment as culture directs what is learnt.[21] The centrality of language is seen in human cognition through the role it plays in establishing and transmitting culture, shaping one's mental representations, and the way in which one interacts with the world.[22] There is substantial diversity in the lexical patterns, phonology, grammar, pragmatic, and reading systems across cultures.[21] Even seemingly universal words, including words for time, space, kin relations, and body parts, vary. For example, the word "eat" in English excludes drinking and smoking, whereas in Turkish, the equivalent word is more general and may refer to either drinking or smoking.[22]

Limitations

Categorization of individuals as "cognitively normal" relied on self-report and performance on a screening test rather than a comprehensive clinical evaluation. There is a possibility that some participants with a degree of cognitive impairment may have been included. Also, the bilingual status of participants was not recorded. Bilingual individuals may perform better on certain tasks, such as tasks of inhibition.[23] Thus, bilingualism is important to consider in cross-cultural studies as it may affect the performance of a cognitive screening tool.

CONCLUSION

Despite control for sociodemographic factors, there were differences in performance of the MoCA-H between English, French, Greek, and German groups, which may be attributed to cultural and linguistic factors. It may therefore be inappropriate to apply performance criteria derived from English populations to versions of the MoCA-H in other languages. Translated versions of the MoCA-H require re-validation to establish optimal cut points for each population. In addition to translation, cultural adaption may mitigate differences between language versions of the MoCA-H. Cultural adaptation may be even more relevant for translations to non-European languages with less cultural overlap with English.

AUTHOR CONTRIBUTIONS

Concept and Design: Stacey Theocharous, Greg Savage, Anna Pavlina Charalambous, Mathieu Côté, Renaud David, Kathleen Gallant, Catherine Helmer, Robert Laforce, Iracema Leroi, Ralph N. Martins, Ziad Nasreddine, Antonis Politis, David Reeves, Gregor Russell, Marie-Josée Sirois, Hamid R. Sohrabi, Chyrssoula Thodi, Christiane Völter, Wai Kent Yeung, and Piers Dawes. Acquisition of subjects and/or data: Anna Pavlina Charalambous, Mathieu Côté, Renaud David, Kathleen Gallant, Catherine Helmer, Robert Laforce, Iracema Leroi, Ralph N. Martins, Ziad Nasreddine, Antonis Politis, David Reeves, Gregor Russell, Marie-Josée Sirois, Hamid R. Sohrabi, Chyrssoula Thodi, Christiane Völter, Wai Kent Yeung, and Piers Dawes. Analysis and interpretation of data: Stacey Theocharous, Greg Savage, Anna Pavlina Charalambous, Mathieu Côté, Renaud David, Kathleen Gallant, Catherine Helmer, Robert Laforce, Iracema Leroi, Ralph N. Martins, Ziad Nasreddine, Antonis Politis, David Reeves, Gregor Russell, Marie-Josée Sirois, Hamid R. Sohrabi, Chyrssoula Thodi, Christiane Völter, Wai Kent Yeung, and Piers Dawes. Preparation of manuscript: Stacey Theocharous, Greg Savage, and Piers Dawes.

FINANCIAL DISCLOSURE

This work was supported by the European Union's Horizon 2020 research and innovation program under grant agreement number 668648. Piers Dawes is supported by the NIHR Manchester Biomedical Research Centre under grant [BRC-1215-20007].

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to disclose.

SPONSOR'S ROLE

None.

ORCID

Hamid R. Sohrabi https://orcid.org/0000-0001-8017-8682
Piers Dawes https://orcid.org/0000-0003-3180-9884

TWITTER

Piers Dawes *PiersDawes*

REFERENCES

1. Muangpaisan W, Petcharat C, Srinonprasert V. Prevalence of potentially reversible conditions in dementia and mild cognitive impairment in a geriatric clinic. *Geriatr Gerontol Int*. 2011;12(1):59-64. doi:10.1111/j.1447-0594.2011.00728.x
2. Yaffe K. Modifiable risk factors and prevention of dementia: what is the latest evidence? *JAMA Intern Med*. 2018;178(2):281-282.
3. Ojeda N, Aretouli E, Peña J, Schretlen DJ. Age differences in cognitive performance: a study of cultural differences in historical context. *J Neuropsychol*. 2014;10(1):104-115. doi:10.1111/jnp.12059
4. Khan G, Mirza N, Waheed W. Developing guidelines for the translation and cultural adaptation of the Montreal cognitive assessment: scoping review and qualitative synthesis. *BJPsych Open*. 2022;8(1):e21. doi:10.1192/bjo.2021.1067
5. Nasreddine ZS, Phillips NA, Bedirian V, et al. The Montreal cognitive assessment, MoCA: a brief screening tool for mild cognitive impairment. *J Am Geriatr Soc*. 2005;53(4):695-699. doi:10.1111/j.1532-5415.2005.53221.x
6. Cova I, Nicotra A, Maestri G, Canevelli M, Pantoni L, Pomati S. Translations and cultural adaptations of the Montreal cognitive assessment: a systematic and qualitative review. *Neurological Sciences*. 2022;43(1):113-124. doi:10.1007/s10072-021-05716-y
7. Davis AC. The prevalence of hearing impairment and reported hearing disability among adults in Great Britain. *Int J Epidemiol*. 1989;18(4):911-917. doi:10.1093/ije/18.4.911

8. Jorgensen LE, Palmer CV, Pratt S, Erickson KI, Moncrieff D. The effect of decreased audibility on MMSE performance: a measure commonly used for diagnosing dementia. *J Am Acad Audiol*. 2016;27(4):311-323. doi:10.3766/jaaa.15006
9. Dawes P, Reeves D, Yeung WK, et al. Development and validation of the Montreal cognitive assessment for people with hearing impairment (MoCA-H). *J Am Geriatr Soc*. 2023;71(5): 1485-1494. doi:10.1111/jgs.18241
10. O'Driscoll C, Shaikh M. Cross-cultural applicability of the Montreal cognitive assessment (MoCA): a systematic review. Chopard G, ed. *J Alzheimer's Dis*. 2017;58(3):789-801. doi:10.3233/jad-161042
11. Larouche E, Tremblay MP, Potvin O, et al. Normative data for the Montreal cognitive assessment in middle-aged and elderly Quebec-French people. *Arch Clin Neuropsychol*. 2016;31(7): 819-826. doi:10.1093/arclin/acw076
12. Poptsi E, Moraitou D, Eleftheriou M, et al. Normative data for the Montreal cognitive assessment in Greek older adults with subjective cognitive decline, mild cognitive impairment and dementia. *J Geriatr Psychiatry Neurol*. 2019;32(5):265-274. doi:10.1177/0891988719853046
13. Thomann AE, Goettel N, Monsch RJ, et al. The Montreal cognitive assessment: normative data from a German-speaking cohort and comparison with international normative samples. Bondi M, ed. *J Alzheimer's Dis*. 2018;64(2):643-655. doi:10.3233/jad-180080
14. Frank T, Durrant JD, Lovrinic JM. Maximum permissible ambient noise levels for audiometric test rooms. *Am J Audiol*. 1993;2(1):33-37. doi:10.1044/1059-0889.0201.33
15. Brodaty H, Pond D, Kemp NM, et al. The GPCOG: a new screening test for dementia designed for general practice. *J Am Geriatr Soc*. 2002;50(3):530-534. doi:10.1046/j.1532-5415.2002.50122.x
16. Hall MK, Kea B, Wang R. Recognising bias in studies of diagnostic tests part 1: patient selection. *Emerg Med J*. 2019;36(7): 431-434. doi:10.1136/emermed-2019-208446
17. Dawes P, Pye A, Reeves D, et al. Protocol for the development of versions of the Montreal cognitive assessment (MoCA) for people with hearing or vision impairment. *BMJ Open*. 2019; 9(3):e026246. doi:10.1136/bmjopen-2018-026246
18. Völter C, Fricke H, Götze L, et al. Evaluation of the non-auditory neurocognitive test MoCA-HI for hearing-impaired. *Frontiers in Neurology*. 2022;13:1022292.
19. Cha ES, Kim KH, Erlen JA. Translation of scales in cross-cultural research: issues and techniques. *J Adv Nurs*. 2007; 58(4):386-395. doi:10.1111/j.1365-2648.2007.04242.x
20. Faul F, Erdfelder E, Lang A-G, Buchner A. G*power 3.1 [computer software]. 2007. http://www.gpower.hhu.de/
21. Ardila A. The impact of culture on neuropsychological test performance. *International Handbook of Cross-Cultural Neuropsychology*. Psychology Press; 2007.
22. Lupyan G. The centrality of language in human cognition. *Language Learn*. 2015;66(3):516-553. doi:10.1111/lang.12155
23. Marian V, Shook A. The cognitive benefits of being bilingual. *Cerebrum*. 2012;2012:13.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supplementary Table S1. Hierarchical regression analysis for variables predicting MoCA-H domains ($n = 385$).

How to cite this article: Theocharous S, Savage G, Charalambous AP, et al. A cross-cultural study of the Montreal Cognitive Assessment for people with hearing impairment. *J Am Geriatr Soc*. 2024;1-7. doi:10.1111/jgs.19020