Aging & Mental Health

ISSN: 1360-7863 (Print) 1364-6915 (Online) Journal homepage: www.tandfonline.com/journals/camh20

Validation of the Arabic Rowland Universal Dementia Assessment Scale (A-RUDAS) in elderly with mild and moderate dementia

M. Chaaya, T.K.T. Phung, K. El Asmar, S. Atweh, H. Ghusn, R.M. Khoury, M. Prince, T.R. Nielsen & G. Waldemar

To cite this article: M. Chaaya, T.K.T. Phung, K. El Asmar, S. Atweh, H. Ghusn, R.M. Khoury, M. Prince, T.R. Nielsen & G. Waldemar (2016) Validation of the Arabic Rowland Universal Dementia Assessment Scale (A-RUDAS) in elderly with mild and moderate dementia, Aging & Mental Health, 20:8, 880-887, DOI: 10.1080/13607863.2015.1043620

To link to this article: https://doi.org/10.1080/13607863.2015.1043620

Published online: 18 May 2015.

Submit your article to this journal

Article views: 860

View related articles

View Crossmark data

Citing articles: 15 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=camh20

Aging & Mental Health, 2016
Vol. 20, No. 8, 880−887, http://dx.doi.org/10.1080/13607863.2015.1043620

Routledge
Taylor & Francis Group

Validation of the Arabic Rowland Universal Dementia Assessment Scale (A-RUDAS) in elderly with mild and moderate dementia

M. Chaaya[a], T.K.T. Phung[b], K. El Asmar[a]*, S. Atweh[c], H. Ghusn[d], R.M. Khoury[a], M. Prince[e], T.R. Nielsen[b] and G. Waldemar[b]

[a]*Department of Epidemiology and Population Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon;* [b]*Department of Neurology, Danish Dementia Research Center, The Neuroscience Center, University of Copenhagen, Copenhagen, Denmark;* [c]*Department of Neurology, American University of Beirut Medical Center, Beirut, Lebanon;* [d]*Department of Geriatrics, American University of Beirut Medical Center, Beirut, Lebanon;* [e]*Department of Health Service and Population Research, Institute of Psychiatry, King's College London, London, UK*

(*Received 10 February 2015; accepted 14 April 2015*)

Objectives: Validated screening tests for dementia in Arabic are lacking. Given the low levels of education among elderly in the Middle East and North Africa region, the commonly used screening instrument, the Mini Mental State Examination, is not best suited. Alternatively, the Rowland Universal Dementia Assessment Scale (RUDAS) was especially designed to minimize the effects of cultural learning and education. The aim of this study was to validate the RUDAS in the Arabic language (A-RUDAS), evaluate its ability to screen for mild and moderate dementia, and assess the effect of education, sex, age, depression, and recruitment site on its performance.
Methods: A-RUDAS was administered to 232 elderly aged ≥65 years recruited from the communities, community-based primary care clinics, and hospital-based specialist clinics. Of these, 136 had normal cognition, and 96 had dementia. Clinicians diagnosed dementia according to the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) criteria. Interviewers, blind to the cognitive status of participants, administered A-RUDAS. The psychometric properties of A-RUDAS were examined for three cutoffs.
Results: At the cutoff of ≤22, A-RUDAS exhibited good sensitivity (83%) and specificity (85%) with an area under the receiver operating characteristic curve of 83.95%. Adjusting for age, sex, education, depression, and recruitment site, A-RUDAS score demonstrated a high level of accuracy in screening for mild and moderate dementia against DSM-IV diagnosis.
Conclusion: The A-RUDAS is proposed for dementia screening in clinical practice and in research in Arabic-speaking populations with an optimal cutoff of ≤22.

Keywords: RUDAS; validation; dementia; Lebanon

Introduction

According to the World Health Organization (2012), the world's population over 60 years will double, and that over 80 years will quadruple, between 2000 and 2050. The vast majority (80%) of those will live in low- and/or middle-income countries (LMIC). Lebanon, an LMIC, ranks the 75th out of 201 countries with respect to the percentage of the population aged 60 years or older in 2013 (11.9%) (World Population Ageing Report, 2013). Along with this trend in ageing, population surfaces an increased burden from non-communicable diseases, specifically neurodegenerative diseases that cause cognitive and behavioral impairment such as dementia disorders. These conditions elicit much suffering and morbidity both to those affected by them and their family members. Persons with dementia gradually lose their ability to live independently and require various forms of long-term care (home-, community-, residential- and hospital-based) (World Health Organization, 2012).

Despite the rapid increase in the proportion of elderly in the Arab region, data on the prevalence of dementia are scarce. Only two studies were identified in Lebanon. One study, conducted in 2007, reported that almost 60% of nursing home residents had some form of dementia, almost 50% of whom had severe dementia (Chahine, Bijlsma, Hospers, & Chemali, 2007). A more recent study surveyed a sample of 1200 elderly, aged 65 years and older, from rural areas, using a modified version of the mini mental state examination (MMSE). This study reported high levels of cognitive dysfunction (23.2 %), reaching 35 % among women (Boulos, Salameh, & Barberger-Gateau, 2013). At a first glance, these proportions are alarming, but they are nevertheless unreliable as population estimates, something which the authors themselves fully acknowledge. Both the sampling technique (nursing homes selected on the basis of willingness to participate; and only a random sample of rural elderly) and the screening tool selected − MMSE − are probable culprits in these possibly inflated figures. Coupled with the increase in the elderly population, these estimates emphasize the need for accurate screening measures for the identification of dementia, especially that the benefits of early diagnosis

*Corresponding author. Email: ke05@aub.edu.lb

© 2015 Taylor & Francis

have been clearly established. Such benefits include access to available pharmacologic and psychosocial interventions, and delayed institutionalization and with resultant societal benefits and net savings (Prince et al., 2013).

The Eastern Mediterranean Region (EMR) includes 23 nations, 20 of them are Arab States lying in North Africa, east and west Asia. EMR countries are characterized by dissimilarities at many levels from the historical background to cultural aspects. Although Arabic is the official language of most EMR countries, their spoken languages are very different, including Arabic in different dialects.

MMSE is one of the most widely used screening tests for dementia globally and in the Eastern Mediterranean Region (EMRO) (Mitchell, 2009; Scazufca, Almeida, Vallada, Tasse, & Menezes, 2009), despite the fact that several studies have confirmed that it is affected by age, sex, and educational level (Brayne & Calloway, 1990; Fratiglioni et al., 1993; Launer, Dinkgreve, Jonker, Hooijer, & Lindeboom, 1993; O'connor, Pollitt, Treasure, Brook, & Reiss, 1989; Tombaugh & McIntyre, 1992). MMSE appears to be a beneficial tool to rule out dementia in community and primary care settings; its usefulness as a diagnostic tool, especially in populations that are culturally and/or linguistically diverse and with high levels of illiteracy, is questionable (Ismail, Rajji, & Shulman, 2010). MMSE requires arithmetical ability and reading and writing skills, and therefore is not suitable for Arabic-speaking populations in EMRO where a high proportion of elderly are illiterate.

The deficit perceived in the MMSE, specifically with respect to its cultural and linguistic sensitivity, led to the development of the Rowland Universal Dementia Assessment Scale (RUDAS), a 'multicultural cognitive assessment scale' (Storey, Rowland, Conforti, & Dickson, 2004). RUDAS contains six items: testing memory (registration and recall), body orientation, praxis, drawing, judgment, and language, adding up to a total score of 30 with lower scores indicating poorer cognitive function. The original validation study in a multicultural community with both English and non-English speaking individuals of various ethnic backgrounds reported an optimal cut-off score of ≤22 with a sensitivity of 89% and specificity of 98% (Storey et al., 2004). Less than 20 published studies have used RUDAS, most of which were conducted in Australia among different geographic and ethnic populations (Pang, Yu, Pearson, Lynch, & Fong, 2009). However, the RUDAS has also been validated in a multicultural populations in other high-income countries (Nielsen et al., 2013), as well as monocultural populations from several LMIC, including Thailand, Iran, India, and Malaysia (Iype et al., 2006; Limpawattana, Tiamkao, Sawanyawisuth, & Thinkhamrop, 2012; Nielsen, Vogel, Gade, & Waldemar, 2012; Salary, Shaeiri, & Asghari-Moghadam, 2014; Shaaban, Aziz, Abdullah, & Ab Razak, 2013). Sex, years of education, and preferred language were not associated with dementia as diagnosed by RUDAS, while age was found to be a significant predictor. (Storey et al., 2004) Subsequent studies in multicultural populations in Australia and Denmark have consistently reconfirmed this finding (Basic, Rowland, et al., 2009; Gonçalves, Arnold, Appadurai, & Byrne, 2011; Nielsen et al., 2013; Rowland, Basic, Storey, & Conforti, 2006), whereas a slight educational bias has been reported in some studies with LMIC populations (Iype et al., 2006; Limpawattana, Tiamkao, & Sawanyawisuth, 2012; Limpawattana, Tiamkao, Sawanyawisuth, & Thinkhamrop, 2012; Nielsen et al., 2012). When RUDAS was compared to the standardized MMSE and the Informant Questionnaire on Cognitive Decline in the Elderly, it displayed the highest specificity and positive likelihood ratio (Gonçalves et al., 2011). Sensitivity and specificity ranged between 66%–89% and 61.8%–98%, depending on the characteristics of the study population and the cut-off point used (Basic, Khoo, et al., 2009; Basic, Rowland, et al., 2009; Gonçalves et al., 2011; Ismail et al., 2010; Iype et al., 2006; Limpawattana, Tiamkao, Sawanyawisuth, & Thinkhamrop, 2012; Storey et al., 2004).

The aim of this study was (1) to validate an Arabic version of the Rowland Universal Dementia Assessment Scale (A-RUDAS) in order to assess its reliability and validity among an Arabic-speaking population, with associated measures of sensitivity, specificity, and area under the receiver operating characteristic (ROC) curve (AUC); and (2) to evaluate its performance in different settings (community vs. institution), depressed and non-depressed subjects, males and females, different age groups, and those with formal and no formal education.

Methods

RUDAS was tested in a validation study that included three different instruments to screen for and diagnose dementia in clinical practice and in research (Phung et al., 2014). Phung et al (2014) provide specific details on the study design and methods. The English RUDAS was independently translated to classical Arabic and back translated by two research assistants who were Master of Public Health (MPH) graduates and fluent in both English and Arabic. The translated RUDAS was pilot tested on 10 individuals under normal field conditions, to evaluate its burden and acceptability.

Participants enrolled in the study were from the communities, social organizations for the elderly, community-based primary care clinics as well as hospital-based geriatric and neurological clinics. We included participants aged 65 years and above and with normal cognitive status or mild to moderate dementia. Participants with mild cognitive impairment, diagnosed according to the core clinical criteria for mild cognitive impairment (MCI) by the National Institute on Aging – Alzheimer's Association Workgroups (Albert et al., 2011), or with severe somatic or psychiatric illness were excluded. A total of 244 participants were recruited. Twelve participants were excluded; 2 with missing data, and 10 could not perform the visuo-constructional test (drawing a cube) due to poor vision or musculoskeletal problems. Data on RUDAS was available on 232 participants: 136 with normal cognition (controls) and 96 with dementia (cases), of whom 51 had mild and 45 had moderate dementia.

In the communities, social organizations, community-based and hospital-based clinics, participants (controls and cases) were recruited by nurses, social workers, community members, geriatricians, and neurologists. In the hospital-based specialist clinics, geriatricians and neurologists diagnosed dementia cases. A physician from the research team revised the case notes of the patients and discussed with the specialists to reach an agreement about the cognitive status of the participants and decide whom to include or exclude from the study. In the social organization and community-based primary care clinics, the staff nominated cases with cognitive complaints. Physicians from the research team clinically assessed the nominated participants and interviewed their caregivers to diagnose dementia. Dementia was diagnosed according to Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), fourth edition (American Psychiatric Association, 2000). Criteria for dementia severity were rated using Clinical Dementia Rating Scale (Morris, 1993). A score of less than 1 indicates normal cognition, while a score of 1, 2, and 3 indicates mild, moderate, and severe dementia respectively. Depression was diagnosed using the geriatric mental state (GMS) (Copeland et al., 1976).

Trained interviewers, who were three neurological fellows, one geriatric fellow, one family medicine resident, and a Public Health Graduate (MPH), administered A-RUDAS to the elderly participants. Interviewers were blind to the cognitive status of the participants.

Quality control was performed by the study coordinator and the Arabic-speaking research assistant. They accompanied the trained interviewers on multiple field trips and attended the interviews in order to assure that data collection was being done in a standardized manner among all the interviewers. In addition, the study coordinator and the research assistant revised every interview script to check for potential mistakes, held weekly meetings with all the interviewers to correct the mistakes found during the script revision, and discussed any challenge encountered during field work and how to overcome it. Data collection took place from March 2012 till the end of February 2013.

This study was approved by the Institutional Review Board of the American University of Beirut. After reading and understanding the informed consent, the participants gave their written consent to participate in the study. If they were illiterate, the informed consent was read out to them and an oral informed consent was given in the presence of a witness. Decision-making capacity was assessed through a check list (the checklist included various questions such as the purpose of the study, participant's rights, and confidentiality issues) in all participants with dementia in order to ensure that they were capable of understanding the nature of the study and give consent to participate. If they were not, then the main caregiver or legal guardian would provide the written consent on their behalf.

Statistical analysis

RUDAS scores were calculated as mean scores ± standard deviation and the difference in mean RUDAS scores were compared between controls, mild, and moderate dementia. Scores were then divided into three cut-off points (≤ 21, ≤ 22, and ≤ 23). Using the clinical diagnosis of dementia as the reference/gold standard, sensitivity (Se), specificity (Sp) (with their respective 95% confidence interval (CI)), area under the ROC curve (AUC), and percentage correctly classified were calculated for each of the specified cut-off points. Youden Index (defined as $J = \max$ (sensitivity + specificity -1)) was also calculated in order to help determine the optimal cut-off point. In addition, positive predictive value (PPV), positive likelihood ratio (LR+), and negative likelihood ratio (LR−) were computed with their 95% CI. Further stratification of the analysis was performed based on: (1) recruitment site (community vs. institution), (2) education (no formal education vs. formal education), (3) sex of the participant (male vs. female), (4) age group in year intervals (65−74, 75−84 and 85 or more), and (5) depression status (depressed vs. non-depressed). In addition to the stratified analysis, we studied how an adjusted total RUDAS score will affect the outcome using a logistic regression model adjusted for age, sex, education, depression status, and recruitment site. Psychometric properties of the adjusted RUDAS score were also calculated. The reliability of RUDAS was assessed by computing Cronbach alpha as a measure of internal consistency.

Results

The characteristics of the whole sample and of each dementia group are presented in Table 1. A higher proportion of persons with moderate dementia are noted among the older age groups. The average age of all participants was 79.1 years ± 8.1 years. Two-third of the study population was females. The same proportions of males and females were found among controls, mild, and moderate dementia groups. The majority of our sample had no formal education (51.7%); 29.7% had completed primary but not secondary education, 11.64% and 6.9% had, respectively, completed secondary and university education. Controls were more likely to have formal education compared to mild and moderate dementia participants. A larger proportion of participants with normal cognition and mild dementia were recruited from the community. Depression was present in about half of the study sample, both among controls and cases. The three dementia groups were statistically significantly different in regard to age group, education, and recruitment location. The mean A-RUDAS score for participants with dementia was 17.05 ± 7.05 (20.22 mild and 13.47 moderate) compared to 26.54 ± 3.11 for participants with normal cognition. The difference was statistically significant ($p < 0.01$).

Table 2 presents the psychometric properties of A-RUDAS for all participants using three cut-off points; ≤ 21, ≤ 22, and ≤ 23. The highest sensitivity (92) was noted for the highest cutoff (≤ 23). However, this cutoff gave the lowest specificity (78). The PPV at this cutoff was 75 with a LR+ of 4.16 and a LR− of 0.11. The ≤ 22 cutoff gave a good balance between sensitivity and specificity (83 and 85, respectively). The PPV was 79 and the

Table 1. Characteristics of participants by dementia status.

		Non-demented $N = 136$		Mild dementia $N = 51$		Moderate dementia $N = 45$		
		N	%	***N***	%	***N***	%	*p*-value
Age	65−74	60	44.12	7	13.73	7	15.56	<0.001*
	75−84	48	35.29	30	58.82	18	40.00	
	85+	28	20.59	14	27.45	20	44.44	
Gender	Males	53	38.97	18	35.29	13	28.89	0.230
	Females	83	61.03	33	64.71	32	71.11	
Education	No formal education	61	44.85	29	56.86	30	66.67	<0.001*
	Formal education	75	55.15	22	43.14	15	33.33	
Recruitment location	Community	98	72.06	31	60.78	20	44.44	0.001*
	Nursing home	38	27.94	20	39.22	25	55.56	
Depression status	Non-depressed	67	49.26	29	56.86	21	46.67	0.882
	Depressed	69	50.74	22	43.14	24	53.33	

Note: *N*: number of observations.
*significant *p*-value < 0.05.

LR+ and LR− were 5.40 and 0.20, respectively. However, looking at the Youden Index and AUC, one would find that the cutoff (≤23) provides the best overall discriminatory ability.

Sensitivity and specificity analyses including AUC's were repeated (Table 3) taking into consideration the three cutoffs stratified by place of recruitment (community/institution), education (formal/non formal), sex (male/female), age in groups (65−74, 75−84, and 85+), and depression status (depressed/non-depressed). The lowest cutoff of ≤21 had the best balance of sensitivity and specificity for those with no formal education (83 and 85, respectively), and aged 85 or more (79 and 75, respectively). Sex and depression did not considerably affect the psychometric properties. However, it should be noted that for females and the non-depressed, the cutoff (≤22) showed the best balance of sensitivity and specificity (84 and 82, respectively). The highest cutoff chosen (≤23) gave the best psychometric results for those with formal education (81 and 83, respectively) and those seen in the community (Se 90, Sp82). The Cronbach alpha for A-RUDAS items was 0.87. When analyzed as continuous total score adjusted for sex, age, education, depression, and recruitment site, the A-RUDAS exhibited psychometric properties similar to the lowest cutoff chosen (≤21) (Table 2) (Se 76 and Sp 90), only with a better AUC which can be explained by the added variables used for adjustment. It is worth noting that none of the adjusting variables were significantly associated with the outcome, indicating that their presence in the model had limited impact on the A-RUDAS discriminatory power.

Discussion

The study showed that A-RUDAS is a good short screening test with very good psychometric properties among different types of older adults irrespective of their demographic characteristics and depression status.

Research from Australia has reported that both patients who were diagnosed using RUDAS and physicians who administered it were satisfied with the scale (Pang et al., 2009). Moreover, surveyed clinicians showed a preference for RUDAS over MMSE for culturally and linguistically diverse populations (Pang et al., 2009). However, we experienced that some items of the A-RUDAS were particularly challenging for participants (with and without dementia) with no formal education. One item was the visuoconstructional test, when the participants were asked to draw the cube. Almost half of the participants(51%) with no formal education failed to do

Table 2. Psychometric properties of RUDAS for all participants (overall).

	Overall RUDAS ($N = 232$)							
Cut-off point	Se (%) (95% CI)	Sp (%) (95% CI)	YI (%) (95% CI)	Correctly classified (%)	AURoc (%)	PPV	Positive likelihood ratio	Negative likelihood ratio
≤21	77 (67, 85)	89 (82, 94)	66 (56, 76)	84.05 (79, 89)	83.03 (78, 88)	83 (74, 90)	6.99 (4.28, 11.40)	0.26 (0.18, 0.37)
≤22	83 (74, 90)	85 (77, 90)	68 (58, 78)	84.05 (79, 89)	83.95 (79, 88)	79 (70, 87)	5.40 (3.61, 8.08)	0.20 (0.13, 0.31)
≤23	92 (84, 96)	78 (70, 85)	70 (61, 79)	83.62 (78, 88)	84.80 (80, 89)	75 (66, 82)	4.16 (3.01, 5.73)	0.11 (0.05, 0.21)

Note: Se: sensitivity; Sp: specificity; CI: confidence interval; YI: Youden index; AURoc: area under ROC curve; and N: number of observations.

Table 3. Psychometric properties of RUDAS stratified by selected participants' characteristics.

	Cutoffs of RUDAS								
	≤21			≤22			≤23		
	Se (%) (95% CI)	Sp (%) (95% CI)	AUC (%)	Se (%) (95% CI)	Sp (%) (95% CI)	AUC (%)	Se (%) (95% CI)	Sp (%) (95% CI)	AUC (%)
Overall RUDAS ($N = 232$)	77 (67, 85)	89 (82, 94)	83.03	83 (74, 90)	85 (77, 90)	83.95	92 (84, 96)	78 (70, 85)	84.80
Recruitment site: Community ($N = 149$)	73 (58, 84)	95 (88, 98)	83.72	78 (65, 89)	89 (81, 94)	83.60	90 (79, 97)	82 (73, 89)	85.91
Institution ($N = 83$)	82 (68, 92)	74 (57, 87)	77.95	89 (76, 96)	74 (57, 87)	81.29	93 (82, 99)	68 (51, 82)	80.88
Education: Formal education ($N = 112$)	68 (50, 82)	92 (83, 97)	79.78	73 (56, 86)	87 (77, 93)	79.82	81 (65, 92)	83 (72, 90)	81.87
No formal education ($N = 120$)	83 (71, 92)	85 (74, 93)	84.15	90 (79, 96)	82 (70, 91)	85.90	98 (91, 100)	72 (59, 83)	85.22
Sex: Male ($N = 84$)	77 (59, 90)	87 (75, 95)	82.11	84 (66, 95)	81 (68, 91)	82.50	90 (74, 98)	77 (64, 88)	83.84
Female ($N = 148$)	77 (65, 86)	90 (82, 96)	83.64	83 (72, 91)	87 (78, 93)	84.91	92 (83, 97)	78 (68, 87)	85.31
Age group: 65−74 (yrs) ($N = 74$)	57 (29, 82)	97 (88, 100)	76.90	64 (35, 87)	93 (84, 98)	78.81	79 (49, 95)	87 (75, 94)	82.62
75−84 (yrs) ($N = 96$)	81 (67, 91)	88 (75, 95)	84.38	88 (75, 95)	83 (70, 93)	85.42	96 (86, 99)	77 (63, 88)	86.46
85+ (yrs) ($N = 62$)	79 (62, 91)	75 (55, 89)	77.21	85 (69, 95)	68 (48, 84)	76.58	91 (76, 98)	61 (41, 78)	75.95
Depression status: Depressed ($N = 115$)	74 (59, 86)	90 (80, 96)	81.88	83 (69, 92)	87 (77, 94)	84.78	93 (82, 99)	77 (65, 86)	85.14
Non-depressed ($N = 117$)	80 (66, 90)	88 (78, 95)	84.03	84 (71, 93)	82 (71, 90)	83.04	90 (78, 97)	79 (67, 88)	84.55

Note: Se: sensitivity; Sp: specificity; CI: confidence interval; AUC: area under ROC curve; N: number of observations; and yrs: years of age.

so, compared to 30% from those with primary to secondary education, and 14% with university education. Another item was the test for praxis when the participants were asked to do rapid alternating movements. Similar observations were found among Turkish illiterates (Nielsen & Jorgensen, 2013). However, these difficulties did not seem to affect the screening accuracy of the RUDAS in our study.

The most widely used and recommended cutoff is ≤22 and this was proposed by the researchers who developed the instrument (Storey et al., 2004). Sensitivity and specificity at this cutoff varied depending of the type of the population surveyed. (Basic, Khoo, et al., 2009; Basic, Rowland, et al., 2009; Gonçalves et al., 2011; Ismail et al., 2010; Limpawattana, Tiamkao, Sawanyawisuth, & Thinkhamrop, 2012; Storey et al., 2004). In some studies, mild cognitive impairment (MCI) was included, while in others, MCI patients were excluded (Storey et al., 2004). In our study, at the recommended cut-off point of ≤22, A_RUDAS showed very good validity measures in terms of sensitivity and specificity (Se 83 and Sp 85), the balance between them, and the Youden Index. The sensitivity and specificity of the Arabic version are very close to those reported by Storey and colleagues (2004) (Se 89 and Sp 98), and to those of Iype and colleagues (2006) (Se 88 and Sp 76), who validated the scale in Kerala, South India. A-RUDAS (with a cutoff of ≤22) was similar to RUDAS-Thai in terms of discriminating power (Limpawattana, Tiamkao, Sawanyawisuth, & Thinkhamrop, 2012). However, the cutoff suggested for RUDAS-Thai was ≤24 for their outpatient geriatric sample with a majority having less than six years of education. The performance of A-RUDAS at the three cutoffs (21, 22, and 23) was better than the Malay and Iranian versions of the scale (Limpawattana, Tiamkao, Sawanyawisuth, & Thinkhamrop, 2012; Salary et al., 2014; Shaaban et al., 2013).

At the recommended cutoff of ≤22, and among those with no formal education, A-RUDAS exhibited very good sensitivity and good balance between sensitivity and specificity. Furthermore, at this cutoff, the test was robust against variability in mental status (depression) and sex. This is in line with most published studies on RUDAS (Basic, Rowland, et al., 2009; Iype et al., 2006; Storey et al., 2004). The stratified analyses that were performed on the three cutoffs also demonstrated that, similar to other mental health scales (e.g. the General Health Questionnaire (Goldberg & Hillier, 1979), the *Geriatric Depression Scale* (Yesavage et al., 1983), the Mental Health Inventory (Veit & Ware, 1983) and others), several cutoffs could be used for dividing the responders into positive or high risk and negative or low risk. The cut-off points are usually derived from ROC analyses and could differ across populations. The results from the adjusted regression model were in agreement with the general hypothesis that the RUDAS and its association with dementia is robust against variability within the basic socio-demographic variables as well as depression status (Storey et al., 2004).

The calculated mean scores of A-RUDAS were very comparable to those reported by Nielsen and coworkers

(Nielsen et al., 2012) (26.8±2.4), who administered an immediately translated RUDAS to cognitively unimpaired Turkish immigrants in Denmark. Compared to the MMSE, the scale was more valid to measure cognitive function in individuals with less than five years of schooling (Nielsen et al., 2012).

The sample size for this validation study is one of the largest reported in the literature on RUDAS. Its strength lies in the inclusion of a diverse group of older adults from both the community and institutions. Selection factors and ascertainment of dementia were done very rigorously and therefore, the internal validity of the study is enhanced.

A particular limitation of the study is the fact that the GMS has not been separately validated in Arabic. It has been validated as part of the Arabic version of the 10/66 Dementia Research Group diagnostic assessment for dementia (Phung et al, 2014). However, literature provides sufficient evidence of its validity in developed and developing countries (Prince et al, 2004).

The A-RUDAS is an accurate and user-friendly scale that can be used for dementia screening in research and in clinical practice. It is valid for both ruling in and ruling out dementia for elderly of various educational and social backgrounds and in both communities and institutions. Recently, research interest has developed in detecting dementia in the primary health care setting. Though it has been estimated that around 39% of individuals afflicted with dementia seek care at specialty clinics (Galvin & Sadowsky, 2012), this percentage generally represents individuals with more advanced dementia. Most persons with mild to moderate dementia initially present to primary care physicians, often for seemingly unrelated problems, are often missed and remain undiagnosed. Undiagnosed dementia increases the risk of delirium, motor vehicle accidents, medication errors, financial difficulties, caregiver burnout, and poor management of comorbid conditions (Lee, Weston, & Hillier, 2013). Therefore, valid short simple screening tests such as RUDAS could be used as a routine practice when patients aged 65 years and older attend primary care clinics. It could be administered by the nurse or the primary care physician with proper training.

Conclusion

The A-RUDAS – which was constructed in classical Arabic to make it useful for all Arabic speaking countries – demonstrated a high level of accuracy in screening for mild and moderate dementia against the gold standard DSM-IV diagnosis. It could be used in clinical settings and in the community for both screening and research purposes instead of the commonly used MMSE. We recommend a score $\leq$22 as the optimal cut-off point when used in both the general population and clinical settings. However, when a study addresses community participants with an acceptable level of education, a higher cutoff of $\leq$23 could be used to improve diagnostic accuracy. Our results corroborate with findings of most studies on RUDAS. Nonetheless, further validations of A-RUDAS are needed in different settings, languages, and larger studies before it is recommended to be widely used for dementia screening in Arabic speaking populations in EMRO.

Acknowledgement

The study was funded by the Fogarty International Center, American National Institute of Health and National Institute of Aging, grant number 1R21AG039333-01 under the program "Brain Disorders in the Developing World: Research Across Lifespan (BRAIN)". The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies. The recruitment was a community effort with contributions from institutions, organizations, and individuals. Above all, the researchers would like to express a deep gratitude to the participants in the study. They would also like to thank the Ministry of Social Affairs' Social Center in Bourj Hammoud; The NGOs Restaurant du Coeur, the ladies from the Board of the Child & Mother Welfare Society, and Ayadina Social Center for the Elderly; Ain W Zein Hospital Geriatric Clinic; Neurology Clinic at AUB Medical Center; geriatric clinics from Al Saydeh Hospital in Antelias, Child & Mother Welfare Society, and Baytouna Nursing Home; primary care clinics from Maronite Nursing Home, Al Saydeh Church in Hamra, and Al Salib Church in Naaba; social workers Glady Farrah and Mona Saliby; Mrs. Dora Chaaya; Dean Iman Nuwayhid and Professor Jihad Makhoul from the Faculty of Health Sciences, AUB; Mrs. Helen Samaha, President of the Lebanese Order of Nursing; Dr Raja Sawaya and Dr Nazem Bassil; for their assistance with recruitment. The research group would also like to thank Dr Ibrahim Zeinaty, Dr Sandrine Salman, Dr Salem Hammoud, Dr Wael Radwan, and Dr Ali Al Ahmar for their work as interviewers in the study. We would also like to thank Alzheimer Association Lebanon for providing the educational materials about dementia for the patients and their caregivers in this study. Finally, we would like to thank Ms. Suzana Al Maali for her thorough literature review, Ms. Sarah Assaad for her rigorous work in finalizing the tables and the references and making the final corrections, and Ms. Yasmine Abou Taha for editing the paper.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Fogarty International Center, American National Institute of Health and National Institute of Aging: Brain Disorders in the Developing World: Research Across Lifespan (BRAIN) [grant number 1R21AG039333-01].

References

Albert, M.S., DeKosky, S.T., Dickson, D., Dubois, B., Feldman, H.H., Fox, N.C., … Petersen, R.C. (2011). The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia, 7*(3), 270–279.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders, fourth edition, text revision, DSM-IV-TR*. Washington, DC: Author.

Basic, D., Khoo, A., Conforti, D., Rowland, J., Vrantsidis, F., LoGiudice, D., … Prowse, R. (2009). Rowland universal dementia assessment scale, mini-mental state examination and general practitioner assessment of cognition in a multicultural cohort of community-dwelling older persons with early dementia. *Australian Psychologist, 44*(1), 40–53.

Basic, D., Rowland, J.T., Conforti, D.A., Vrantsidis, F., Hill, K., LoGiudice, D., … Prowse, R.J. (2009). The validity of the Rowland Universal Dementia Assessment Scale (RUDAS) in a multicultural cohort of community-dwelling older persons with early dementia. *Alzheimer Disease & Associated Disorders, 23*(2), 124–129.

Boulos, C., Salameh, P., & Barberger-Gateau, P. (2013). The AMEL study, a cross sectional population-based survey on aging and malnutrition in 1200 elderly Lebanese living in rural settings: Protocol and sample characteristics. *BMC Public Health, 13*(1), 573.

Brayne, C., & Calloway, P. (1990). The association of education and socioeconomic status with the mini mental state examination and the clinical diagnosis of dementia in elderly people. *Age and Ageing, 19*(2), 91–96.

Chahine, L., Bijlsma, A., Hospers, A., & Chemali, Z. (2007). Dementia and depression among nursing home residents in Lebanon: A pilot study. *International Journal of Geriatric Psychiatry, 22*(4), 283–285.

Copeland, J.R., Kelleher, M.J., Kellett, J.M., Gourlay, A.J., Gurland, B.J., Fleiss, J.L., & Sharpe, L. (1976). A semi-structured clinical interview for the assessment of diagnosis and mental state in the elderly: The Geriatric Mental State Schedule: I. Development and reliability. *Psychological Medicine, 6*(3), 439–449.

Fratiglioni, L., Jorm, A.F., Grut, M., Viitanen, M., Holmén, K., Ahlbom, A., & Winblad, B. (1993). Predicting dementia from the mini-mental state examination in an elderly population: The role of education. *Journal of Clinical Epidemiology, 46*(3), 281–287.

Galvin, J.E., & Sadowsky, C.H. (2012). Practical guidelines for the recognition and diagnosis of dementia. *The Journal of the American Board of Family Medicine, 25*(3), 367–382.

Goldberg, D.P., & Hillier, V.F. (1979). A scaled version of the General Health Questionnaire. *Psychological Medicine, 9*(1), 139–145.

Gonçalves, D.C., Arnold, E., Appadurai, K., & Byrne, G.J. (2011). Case finding in dementia: Comparative utility of three brief instruments in the memory clinic setting. *International Psychogeriatrics, 23*(5), 788–796.

Ismail, Z., Rajji, T.K., & Shulman, K.I. (2010). Brief cognitive screening instruments: An update. *International Journal of Geriatric Psychiatry, 25*(2), 111–120.

Iype, T., Ajitha, B., Antony, P., Ajeeth, N., Job, S., & Shaji, K. (2006). Usefulness of the rowland universal dementia assessment scale in South India. *Journal of Neurology, Neurosurgery & Psychiatry, 77*(4), 513–514.

Launer, L.J., Dinkgreve, M.A., Jonker, C., Hooijer, C., & Lindeboom, J. (1993). Are age and education independent correlates of the mini-mental state exam performance of community-dwelling elderly? *Journal of Gerontology, 48*(6), P271–P277.

Lee, L., Weston, W.W., & Hillier, L.M. (2013). Developing memory clinics in primary care: An evidence–based interprofessional program of continuing professional development. *Journal of Continuing Education in the Health Professions, 33*(1), 24–32.

Limpawattana, P., Tiamkao, S., & Sawanyawisuth, K. (2012). The performance of the Rowland Universal Dementia Assessment Scale (RUDAS) for cognitive screening in a geriatric outpatient setting. *Aging Clinical and Experimental Research, 24*(5), 495–500. doi:10.3275/8296

Limpawattana, P., Tiamkao, S., Sawanyawisuth, K., & Thinkhamrop, B. (2012). Can Rowland Universal Dementia Assessment Scale (RUDAS) replace mini-mental state examination (MMSE) for dementia screening in a Thai geriatric outpatient setting? *American Journal of Alzheimer's Disease and other Dementias, 27*(4), 254-9. DOI: 10.1177/1533317512447886

Mitchell, A.J. (2009). A meta-analysis of the accuracy of the mini-mental state examination in the detection of dementia and mild cognitive impairment. *Journal of Psychiatric Research, 43*(4), 411–431.

Morris, J.C. (1993). The clinical dementia rating (CDR): Current version and scoring rules. *Neurology, 43*(11), 2412–2414.

Nielsen, T.R., Andersen, B.B., Gottrup, H., Lutzhoft, J.H., Hogh, P., & Waldemar, G. (2013). Validation of the Rowland Universal Dementia Assessment Scale for multicultural screening in Danish memory clinics. *Dementia and Geriatric Cognitive Disorders, 36*(5–6), 354–362. doi:10.1159/000354375

Nielsen, T.R., & Jorgensen, K. (2013). Visuoconstructional abilities in cognitively healthy illiterate Turkish immigrants: A quantitative and qualitative investigation. *Clinical Neuropsychology, 27*(4), 681–692. doi:10.1080/13854046.2013.767379

Nielsen, T.R., Vogel, A., Gade, A., & Waldemar, G. (2012). Cognitive testing in non–demented Turkish immigrants — comparison of the RUDAS and the MMSE. *Scandinavian Journal of Psychology, 53*(6), 455–460.

O'connor, D., Pollitt, P., Treasure, F., Brook, C., & Reiss, B. (1989). The influence of education, social class and sex on Mini-Mental State scores. *Psychological Medicine, 19*(03), 771–776.

Pang, J., Yu, H., Pearson, K., Lynch, P., & Fong, C. (2009). Comparison of the MMSE and RUDAS cognitive screening tools in an elderly inpatient population in everyday clinical use. *Internal Medicine Journal, 39*(6), 411–414.

Phung, K.T., Chaaya, M., Waldemar, G., Atweh, S., Asmar, K., Ghusn, H., … Zeinaty, I. (2014). Validation of the 10/66 Dementia Research Group diagnostic assessment for dementia in Arabic: A study in Lebanon. *Journal of Geriatric Psychiatry and Neurology, 27*(4), 282–290. doi:10.1177/0891988714532019

Prince, M., Acosta, D., Chiu, H., Copeland, J., Dewey, M., Scazufca, M., & Varghese, M. (2004). Effects of education and culture on the validity of the Geriatric Mental State and its AGECAT algorithm. *British Journal of Psychiatry, 185*, 429–436.

Prince, M., Bryce, R., Albanese, E., Wimo, A., Ribeiro, W., & Ferri, C.P. (2013). The global prevalence of dementia: A systematic review and metaanalysis. *Alzheimer's & Dementia, 9*(1), 63–75.

Rowland, J.T., Basic, D., Storey, J.E., & Conforti, D.A. (2006). The Rowland Universal Dementia Assessment Scale (RUDAS) and the Folstein MMSE in a multicultural cohort of elderly persons. *International Psychogeriatrics, 18*(1), 111–120.

Salary, S., Shaeiri, M., & Asghari-Moghadam, M.A. (2014). Assessing the validity and reliability of Rowland's Universal Dementia Assessment Scale (RUDAS) in patients with dementia. *Zahedan Journal of Research in Medical Sciences, 16*(9), 72–74.

Scazufca, M., Almeida, O.P., Vallada, H.P., Tasse, W.A., & Menezes, P.R. (2009). Limitations of the Mini-Mental State Examination for screening dementia in a community with low socioeconomic status. *European Archives of Psychiatry and Clinical Neuroscience, 259*(1), 8–15.

Shaaban, J., Aziz, A.A., Abdullah, Z., & Ab Razak, A. (2013). Validation of the Malay Version of Rowland Universal Dementia Assessment Scale (MRUDAS) among elderly attending primary care clinic. *International Medical Journal, 20*(5), 1–4.

Storey, J.E., Rowland, J.T., Conforti, D.A., & Dickson, H.G. (2004). The Rowland Universal Dementia Assessment Scale (RUDAS): A multicultural cognitive assessment scale. *International Psychogeriatrics, 16*(01), 13–31.

Tombaugh, T.N., & McIntyre, N.J. (1992). The mini-mental state examination: A comprehensive review. *Journal of the American Geriatrics Society, 40*(9), 922–935.

Veit, C.T., & Ware, J.E. (1983). The structure of psychological distress and well-being in general populations. *Journal of Consulting and Clinical Psychology, 51*(5), 730−742.

World Health Organization. (2012). *World Health Day 2012: Ageing and health: Toolkit for event organizers*. Geneva: World Health Organization.

World Population Ageing [Online]. (2013). Retrieved September 15, 2014, from http://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2013.pdf

Yesavage, J.A., Brink, T., Rose, T.L., Lum, O., Huang, V., Adey, M., & Leirer, V.O. (1983). Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research, 17*(1), 37−49.