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Comparison of the Rowland Universal Dementia Assessment Scale and Mini-Mental State Examination for dementia detection

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Objective: To assess the ability of the Rowland Universal Dementia Assessment Scale (RUDAS) in comparison to the Mini-Mental State Examination (MMSE) to detect signs of dementia in a diverse elderly population. **Design**: Systematic literature review. **Methods**: Searches were done in PubMed, utilizing the terms MMSE, RUDAS, and dementia. **Results:** Using the keywords mentioned on PubMed, two articles met the inclusion and exclusion criteria: Limpawattana et al and T. R. Nielsen et al. One other article was found by searching under the "Related Articles" section on PubMed: D. Basic et al. **Conclusion:** The RUDAS performs just as well as the MMSE for detecting dementia and is less affected by demographic variables such as education, language, and cultural background.

INTRODUCTION

With the elderly population quickly expanding as the baby boomer generation ages, it is essential to understand one of its pervasive medical conditions: dementia. As defined by the Diagnostic Statistical Manual 5 (DSM-5), dementia is a reduction in cognition in at least one of the following domains: learning and memory, language, executive function, complex attention, perceptual-motor function, and social cognition.[1] The DSM-5 clarifies that this impairment in cognition must be acquired and represent a decline from the person's prior state of function.[1] This cognitive decline must also impede a person's ability to perform activities of daily living and level of independence.[1] Additionally, this change in cognition cannot be better explained by another mental disorder or delirium.[1]

Although Alzheimer disease (AD) is often inaccurately used interchangeably with the term dementia, AD is only one of many syndromes in the dementia spectrum. Examples of major dementia syndromes include AD, as mentioned above, dementia with Lewy bodies, frontotemporal dementia, vascular dementia, and Parkinson disease with dementia.[2] Currently AD is ranked as the 6th leading cause of death in adults in the United States and 60-80% of patients with a form of dementia have AD.[2] Although the disease is prevalent, its diagnosis is often missed in clinical practice.

The Mini-Mental State Examination (MMSE) (Appendix 1) predominates as the cognitive test of choice for detection of dementia.[1] The MMSE is a concise test that can be easily administered in a variety of settings. Its questions examine cognitive functions such as calculation, language manipulation, attention, recall, orientation, and constructional abilities. Although this test functions well, it possesses shortcomings in the setting of a diverse patient population with English-language limitations, cultural barriers, and varying education levels. Furthermore, the MMSE is often translated into other languages, but certain aspects of the test do not translate well, resulting in decreased efficacy. The Rowland Universal Dementia Assessment Scale (RUDAS) (Appendix 1), developed in Australia, is another cognitive test that was specifically designed to overcome the shortcomings of the MMSE.[3] Translating the RUDAS does not alter any aspects of the test or skew results.[3] If the RUDAS is better equipped to detect dementia in a diverse population, maybe it should replace the MMSE as the gold standard to be used in clinic and office settings to reach a greater percentage of the population.

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

CASE

D.S. is a 72-year-old Hispanic male who presents to his primary care office at his daughter's request due to her observation that his forgetfulness has progressively worsened over the past year, and he struggles to complete simple tasks at home. D.S. is a Spanish-speaker with limited English who lives with his daughter's family. We suggest that using the RUDAS for this patient will be much more effective at detection of dementia since the patient is not a native English speaker and his educational background is unknown.

CLINICAL QUESTION

In an increasingly diverse elderly population, is the RUDAS a better tool to detect dementia as compared to the standard MMSE?

METHODS

The only search engine utilized for this review was PubMed. The following keywords were used: MMSE, RUDAS, and dementia. This search produced 12 articles that were evaluated. Of the 12 articles, 2 were chosen that met the inclusion and exclusion criteria as seen in Table 1. A third article was discovered by using the "Related Articles" section of PubMed with the same keywords. It also fit the necessary inclusion and exclusion criteria of our review. Some articles appeared to address our clinical question but were excluded because they had many similar authors. Others were excluded because of study type or inclusion of a gratuitous number of tests and tools. Our criteria specifications resulted in 3 appropriate articles that were included in this review. The final chosen articles were also selected because each focused on separate populations. They were chosen to highlight the comparison of the MMSE and RUDAS in a variety of cultures. Refer to Figure 1 for the PRISMA flowchart.

Table 1. Criteria for Study Search

Inclusion Criteria	Exclusion Criteria
• Articles directly comparing MMSE and RUDAS • Articles published recently (2009-2017) • Culturally diverse populations • Elderly populations • Adequate statistical analyses	• Homogenous populations • Meta-analyses and systematic reviews • Detection tools administered via telemedicine or videoconferencing • Articles focusing on greater than 3 assessment tools • Articles with the same authors

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

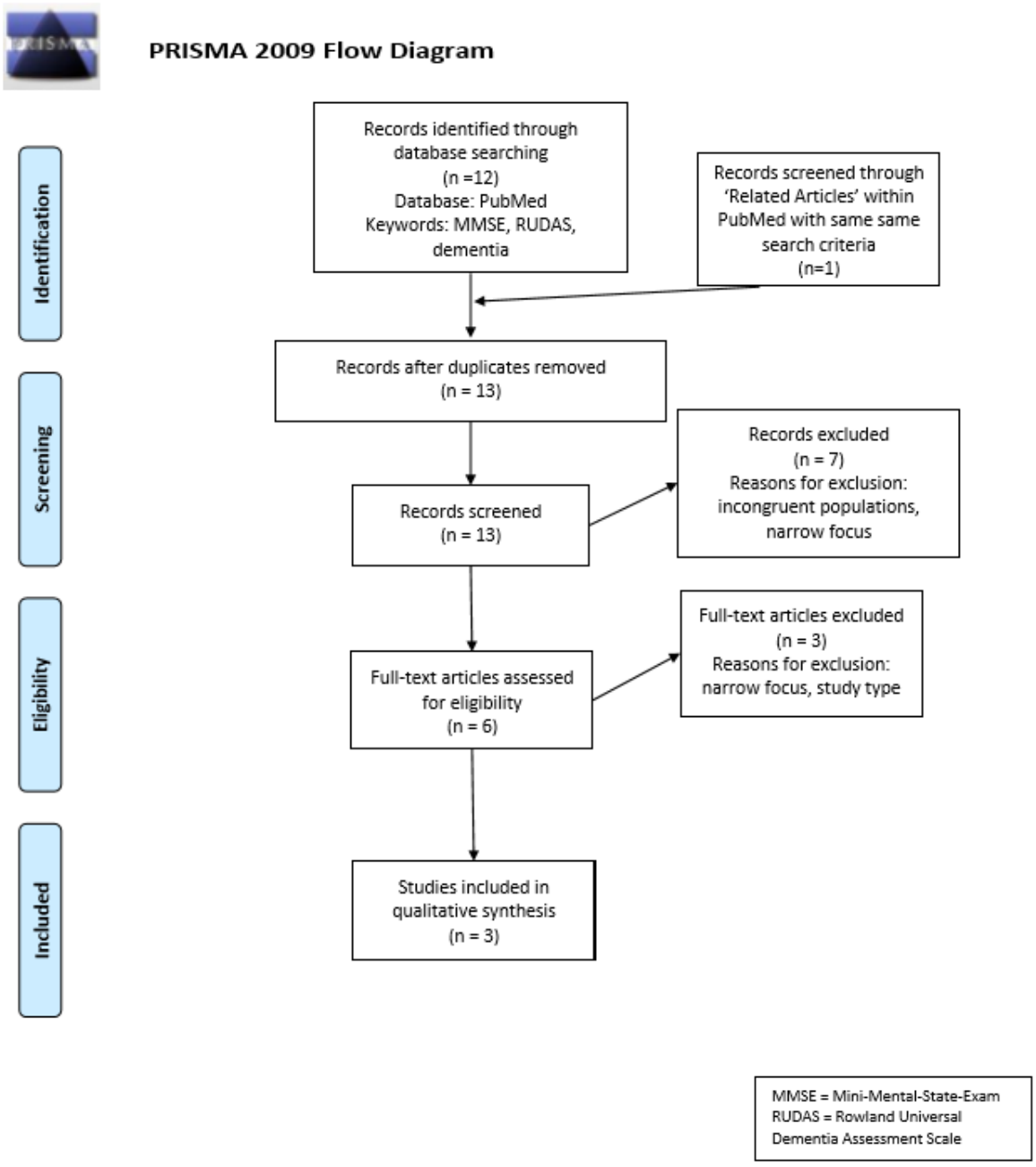


Figure 1. PRISMA Flow Diagram for Study Search

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

RESULTS

Study #1

Can Rowland Universal Dementia Assessment Scale (RUDAS) Replace Mini-Mental State Examination (MMSE) for Dementia Screening in a Thai Geriatric Outpatient Setting? Limpawattana et al. [3]

Objective

To compare the performance of MMSE-Thai 2002 and RUDAS-Thai for dementia screening, and to determine their performances and identify their optimal cut-off points.

Study Design

This was a sub-study of a cross-sectional study of 200 elderly patients in a geriatric, outpatient setting that was conducted from September 2010 to March 2011. Data analysis was conducted by the Faculty of Medicine in the Geriatric and Neurology Clinic at the Khon Kaen University in Thailand. Participants were selected from the Geriatric Clinic and Neurology Clinic of Srinagarind Hospital and were originally referred for a variety of problems associated with physical frailty, neurological conditions, and cognitive impairment. All participants received clinical assessment, physical exam, and standard routine care. The patient criteria are listed in Table 2.

Table 2. Patient Criteria for Study #1

Inclusion Criteria	Exclusion Criteria
• Thai-speaking • ≥60 years old • Willingness to participate (individuals and/or their proxies) • No apparent acute illness that could affect the performance of the study	• Reluctant to complete test • Unable to understand Thai or local language • Lost to follow-up with a geriatrician and a neurologist

Both tests, the RUDAS-Thai and MMSE-Thai 2002, were given to patients in random order by trained people from the geriatric care team. Within 2 weeks of test administration, participants were evaluated for dementia by either a geriatrician or a neurologist according to the DSM-IV criteria. These doctors were blinded to the results of the RUDAS-Thai and MMSE-Thai 2002. In addition to the DSM-IV, the Clinical Dementia Rating was utilized to assess severity of dementia, and the Barthel Activities of Daily Living Index and Lawton activity of daily living score were used to evaluate the patient's daily function.

Receiver operating characteristic (ROC) curves were used to determine the accuracy of the diagnostic tests by calculating the area under the curve (AUC). The sample size was determined via web-based calculator by specifying an AUC of 0.8 and standard error of 0.044. The resulting sample was 200 participants. When analyzing the participant characteristics, categorical variables were represented by percentage and frequency, and continuous variables were reflected with mean and standard deviation. To assess the screening accuracy and preferred cut-off points for the RUDAS-Thai and MMSE-Thai 2002, the following statistical values were obtained: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), Yuden index, AUC, and likelihood ratios.

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Study Results

Of the 200 participants who were assessed and evaluated in this study, 89 had dementia, 89 had no dementia, and 22 had mild cognitive impairment (MCI). To diminish misclassification bias, those with MCI were not included in the primary analyses. When relating results to the characteristics of the participants, those found to have dementia tended to have less education and more informant assistance in comparison to their counterparts with normal cognition. Additionally, those diagnosed with dementia were also found to require more assistance with activities of daily living.

The study analyzed the performance of both tests at various cutoff points as shown in Table 4 for the RUDAS-Thai and Table 5 for MMSE-Thai 2002. More applicable to our analysis in this paper are the ROC curves (plotting true positive rate versus false positive rate) used to evaluate the assessment ability of both tests to pick up signs of dementia. As seen in Table 3, the AUC for the RUDAS-Thai was 0.81 with a 95% confidence interval between 74.8-87.2. Very similarly, the AUC for the MMSE-Thai 2002 was 0.81 with a 95% confidence interval between 74.9-87.4. Scores for both tests were very highly-correlated with a Pearson's coefficient (measurement of linear correlation, between -1 and 1, inclusive) of 0.80 and a 95% confidence interval of 0.745-0.85 with a $p < 0.0001$.

Table 3. ROC Curve Analysis for RUDAS-Thai and MMSE-Thai 2002 with Correlation

Test	AUC	95% CI	Correlation
RUDAS-Thai	0.81	74.8-87.2	Pearson's coefficient: 0.80 95% CI: 0.745-0.85 p<0.0001
MMSE-Thai 2002	0.81	74.9-87.4	

ROC: receiver operating characteristic; RUDAS: Rowland Universal Dementia Assessment Scale; MMSE: Mini-Mental State Examination; AUC: area under curve; CI: confidence interval

Table 4. RUDAS Performance on Dementia Detection According to its Various Cutoff Point

Cutoff points	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Youden Index	AUC under ROC	LR+	LR-
19	38.2	97.8	94.4	61.3	0.742	0.68	17.00	0.632
20	48.3	96.6	93.5	65.2	0.449	0.725	14.30	0.535
21	53.8	91	85.5	65.9	0.448	0.719	5.88	0.519
22	61.8	84.3	79.7	68.8	0.461	0.73	3.93	0.453
23	67.4	82	78.9	71.6	0.494	0.747	3.75	0.397
24	**78.7**	**60.7**	**66.7**	**73.8**	**0.405**	**0.702**	**2.00**	**0.345**
25	79.3	59.6	67	73.6	0.389	0.694	1.96	0.347

PPV: positive predictive value; NPV: negative predictive value; AUC: area under curve; ROC: receiver operating characteristic; LR: likelihood ratio

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Table 5. MMSE-Thai 2002 Performance on Dementia Detection According to its Various Cutoff Point

Cutoff points	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Youden Index	AUC under ROC	LR+	LR-
19	50.6	91	84.9	64.8	0.416	0.708	5.63	0.543
20	56.2	87.6	82	66.7	0.438	0.719	4.55	0.5
21	60.7	83.1	78.3	67.9	0.438	0.719	3.6	0.473
22	67.4	76.4	74.1	70.1	0.438	0.719	2.86	0.426
23	73	73	73	73	0.46	0.73	2.71	0.369
24	**78.7**	**66.3**	**70**	**75.6**	**0.45**	**0.725**	**2.33**	**0.322**
25	89.9	50.6	64.5	83.3	0.405	0.702	1.82	0.2

PPV: positive predictive value; NPV: negative predictive value; AUC: area under curve; ROC: receiver operating characteristic; LR: likelihood ratio

Based on the results of this study, appropriate discriminative properties and sufficient reliability were seen with both the RUDAS-Thai and the MMSE-Thai 2002. The optimal cutoff point for each test was 24 to best screen for dementia in patients. Although both tests functioned similarly, the study concluded that the RUDAS-Thai is a better alternative and could replace the MMSE-Thai 2002 since it does not possess the same limitations. Unlike the MMSE-Thai 2002, the RUDAS Thai was not as strongly influenced by a patient's education level, cultural background, age, or language. Furthermore, the RUDAS-Thai had a shorter administration time and included more cognitive domain assessment features.[3]

Study Critique

Although this study strongly supported the RUDAS-Thai as an alternative assessment for dementia detection, the test was not evaluated on a full spectrum of patients. In fact, its results only pertain to a Thai population. Further studies are necessary to assess the use of the RUDAS in other cultural populations. Since the study was conducted in a tertiary care setting, it is possible that the prevalence of dementia in the general population is higher than what was observed. In this study, the RUDAS and MMSE were compared to an appropriate reference standard, the DSM-IV criteria. However, since long-term follow-up and brain pathology were not conducted, it is possible that there may have been a misclassification bias. Since the diagnosis of dementia is simply clinical, with no possible biomarkers to test, some practitioner bias might have existed during patient evaluation even though the practitioners were blind to the results of the other studies. Additionally, the group of participants in the study had an education level of 6 years or less, thus allowing for results that might be more consistent with those of a lower education level. Finally, gender is considered a risk for dementia. Therefore, additional studies accounting for gender are necessary since there were far less males in the non-dementia group of participants.

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Study #2

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. Basic et al.[4]

Objective

To evaluate and compare the accuracy of the RUDAS, MMSE, and General Practitioner Assessment of Cognition (GPCOG) to diagnose dementia as well as evaluate the influence of age, gender, culturally and linguistically diverse (CALD) status, and years of education on these exams in a group of older, community-dwelling persons.

Study Design

In this cross-sectional study, 151 elderly, community dwelling individuals in Melbourne or Adelaide, Australia were selected who were undergoing routine clinical assessments. See Table 6 for inclusion and exclusion patient criteria. Patients were recruited from memory clinics, an Alzheimer's disease respite program, and multiple other clinics. Patients were referred for a variety of reasons including: normal cognition with a fall or balance issue or enrollment in community therapy, rehabilitation centers, day respite programs, or Alzheimer's disease career groups. Each participant received cognitive assessment from the following professionals: a practitioner specializing in care of the elderly and a research assistant. The DSM-IV criteria, which includes data from the MMSE and GPCOG, were used to diagnose 58/151 participants with dementia. The RUDAS was then used in an independent, blinded fashion on each of the participants.

Table 6. Patient Criteria for Study #2

Inclusion Criteria	Exclusion Criteria
• ≥45 years old • Community dwelling • Living in Melbourne or Adelaide, Australia	• Delirium • Severe hearing, visual, or physical impairment

The sample size of 151 was determined via web-based calculator by specifying an AUC of 0.9 and standard error of 0.03. To compare the accuracy of the RUDAS, MMSE, and GPCOG, a ROC curve analysis was utilized. Sensitivity, specificity, negative likelihood, and positive likelihood ratios were then calculated as well. Finally, three separate multivariate logistic regressions were implemented to evaluate the effect of age, education, CALD status, depression, gender, and MMSE/RUDAS/GPCOG on dementia status.

Study Results

The MMSE, RUDAS, and GPCOG were all highly correlated when using the Spearman's rank-order correlation coefficient, a 95% confidence interval, and a $p < 0.0001$, as seen in Table 7. Since the GPCOG is outside the scope of our clinical question, we will be omitting its results in this section.

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Table 7. Correlation of RUDAS and MMSE

Studies compared	Spearman's rank-order correlation coefficient (r_s)	95% Confidence Interval	P value	n
RUDAS and MMSE	$r_s = 0.78$	0.70-0.84	p< 0.0001	137

RUDAS: Rowland Universal Dementia Assessment Scale; MMSE: Mini-Mental State Examination; n: sample size

The RUDAS and MMSE each had similar AUC, sensitivities, and specificities. These values are compared below in Table 8.

Table 8. Comparison of Studies

Measure	RUDAS	MMSE
AUC (with 95% CI)	0.94 (0.88-0.97)	0.93 (0.87-0.97)
Sensitivity (%) (with 95% CI)	87.7 (76.3-94.9)	84.3 (71.4-93.0)
Specificity (%) (with 95% CI)	90.0 (79.5-96.2)	87.9 (76.7-95.0)

AUC: area under curve; CI: confidence interval; RUDAS: Rowland Universal Dementia Assessment Scale; MMSE: Mini-Mental State Examination; n: sample size

Based on the results seen in Table 8, when compared to the MMSE, the RUDAS appears to be just as accurate. The authors fit two separate logistic regression models to determine the relative effect on probability of dementia based on the testing method and several possible covariates (age, gender, CALD status, education, informant presence, and GDS score). Within each model, the test score, informant presence, and GDS score are statistically significant (type I error rate = 0.20). However, in the model that utilizes MMSE as the test score, CALD status is also a significant covariate. This suggests that the use of the RUDAS score removes the necessity for knowing the CALD status of the patient.

Study Critique

This study had many limitations that may have affected the results. All the participants were originally from 10 European countries which could make it difficult to extrapolate the results globally. To best evaluate the RUDAS, further studies must be done on a broader spectrum of patients. Another limitation was that the participants were diagnosed with dementia using the DSM IV criteria, which includes the MMSE and GPCOG. This factor could easily bias the data. The study included individuals as young as 45 years old, who are far less likely to have dementia than those in a more elderly population. Those interpreting the test were blinded to the results, but since there was no follow-up with these patients, it cannot be confirmed if each patient was correctly diagnosed with dementia. Not only could this change the perception of the diagnostic ability of each screening tool, but it could also affect the control.

Study #3

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Cognitive testing in non-demented Turkish immigrants - comparison of the RUDAS and the MMSE. Nielsen et al.[6]

Objective
To compare performance on the RUDAS and the MMSE in Turkish immigrants in Denmark and determine the impact of demographic and health-related variables on test performance.

Study Design
In this study, a random sample was obtained of 500 elderly Turkish individuals living in the community in Denmark. Inclusion and exclusion criteria are listed in Table 9. Of the 500 individuals, 76 met the criteria and agreed to participate in the study. Each individual was interviewed and screened for depression with an abbreviated GDS. They were then screened for acculturation using a modified version of A Short Acculturation Scale for Hispanics (ASASH). The RUDAS and MMSE were given to each participant by a neuropsychologist in association with an interpreter. The participants were divided into groups based on age, education, and acculturation to better analyze the impact of these variables upon the dementia screening tools.

Table 9. Patient Criteria for Study #3

Inclusion Criteria	Exclusion Criteria
• Turkish immigrant • Residence in Denmark 10 years • ≥50 years old • Current address in greater Copenhagen area • Not registered with a dementia diagnosis in national medical registers • Lives independently	• History of significant memory problems or psychological disease • History of neurological disease (including stroke and traumatic head injury) • History of substance abuse • Physical disabilities that could interfere with cognitive testing (i.e. movement disorders, uncorrected hearing, vision problems)

Statistical analysis was done using the Mann-Whitney U test to compare groups stratified by age, years of schooling, gender, and level of acculturation. To compare frequencies among the various groups, the Pearson's chi-square was utilized. The Spearman's rank-order correlation coefficient was then used to assess the linear relationship between the MMSE and RUDAS. To evaluate the effect of demographics on the performance of each test, a linear regression analysis was conducted.

Study Results
Scores were correlated between the two screening tools ($p<0.001$), however, they were higher throughout for the RUDAS. This finding was especially true for females, those with little education, or those with lower acculturation levels. This study showed no association between health-related variables and scores on the MMSE or RUDAS. As seen in Table 10, performance was correlated with age, education, and acculturation for both the RUDAS and the MMSE, but only the MMSE reflected a correlation with gender.

Table 10. Stratified Performance of RUDAS and MMSE

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Variable	n	RUDAS		MMSE	
Total scores	76	26.82.4		23.74.3	
Age: 50-59 60	 39 37	 27.52.3 26.12.2	 p=0.004	 24.63.6 22.84.7	 p=0.115
Schooling: 0-4 years 5 years	 35 41	 25.92.2 27.52.2	 p=0.002	 20.73.9 26.32.4	 p<0.001
Gender: Male Female	 33 43	 26.92.1 26.72.5	 p=0.759	 25.52.6 22.44.8	 p=0.004
Acculturation: Lower Higher	 41 35	 26.02.3 27.72.1	 p=0.001	 21.74.4 26.12.5	 p<0.001

n: sample size; RUDAS: Rowland Universal Dementia Assessment Scale; MMSE: Mini-Mental State Examination

Two, separate linear regression models were fit to infer the relationship between: 1) MMSE and demographic variables and 2) RUDAS and demographic variables. Models were selected using stepwise selection. For both models, education was the only variable found to be important. The effect of education on MMSE is larger than that of the effect on RUDAS. As seen in Table 11, 44% of the variation in MMSE is explained by education while it is only 15.6% for the RUDAS. This study determined that a patient's performance on the RUDAS is much less affected by a patient's educational background as compared to the MMSE.

Table 11. Linear Regression Analyses: Contribution of Years of Schooling to RUDAS and MMSE Performance

Test	Variable	Regression estimate	p-value	R^2
RUDAS	(intercept) Years of schooling	25.875 0.236	<0.001 <0.001	0.156
MMSE	(intercept) Years of schooling	20.960 0.715	<0.001 <0.001	0.441

RUDAS: Rowland Universal Dementia Assessment Scale; MMSE: Mini-Mental State Examination

Study Critique

One of the main shortcomings of this study is that the participants were limited to a very specific cultural population. Further studies must be conducted to include a broader spectrum of the patient population. Although the patients were evaluated with an independent reference standard, the GDS, it is unclear if the evaluators were blinded to the other results. Additionally,

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

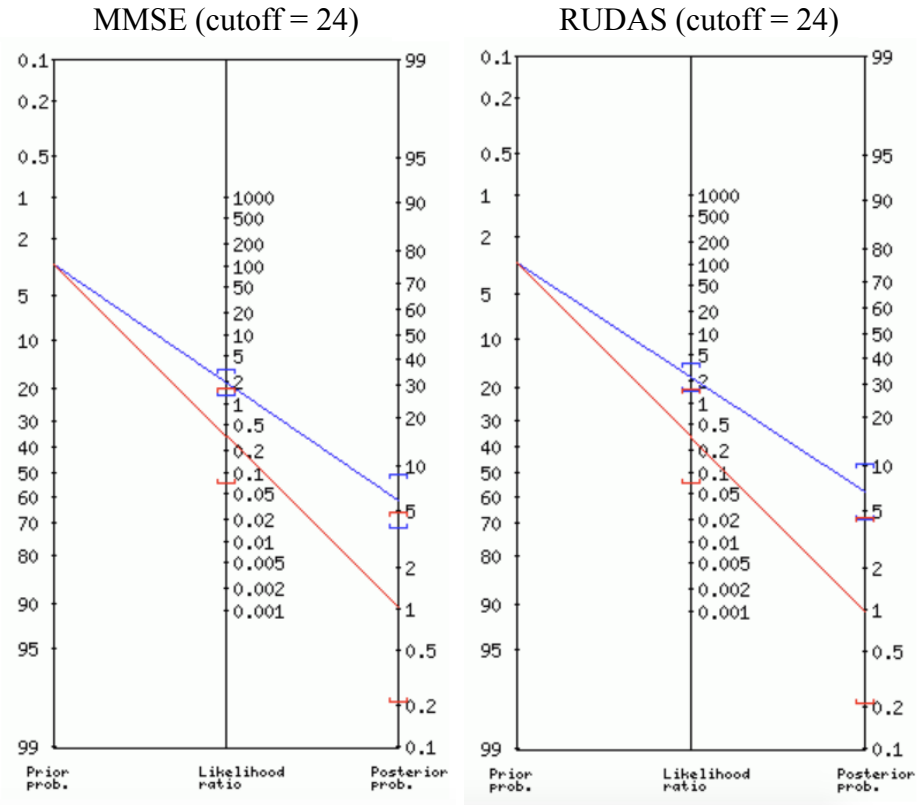
the low age cutoff of 50 years in this study allowed individuals who were relatively young to participate. Inclusion of younger people may have affected results since dementia is much less prevalent in those under 65 years of age. Another limitation of this study was its small sample size which could have greatly altered the results. Lastly, the study had no way of excluding participants who had previous cognitive diagnoses which could have further skewed the results.

DISCUSSION

Dementia is a common disease in the aging population that affects people of all cultures and backgrounds. Currently, the MMSE is considered the gold standard for dementia screening and detection.[1] There is limited evidence to suggest that the MMSE is superior, but most practitioners are more familiar and comfortable using it. Although the MMSE is considered the gold standard, it still lacks the definitive ability to diagnose dementia since the only 100% accurate means is by way of autopsy.

Although all included studies compared the MMSE and RUDAS, each one focused on slightly different aspects of comparison. The first study discussed the appropriate cutoff scores and compared each test's accuracy to detect dementia.[3] Nomograms for each of the tests are shown below in Table 12. The second study compared the accuracy of the tests, as well, but also addressed the combined effects of each test and demographics (e.g. age, education, culture) on dementia.[4] The final study investigated the effect of demographics on assessment scores.[6] Even though differences existed among the studies, each one reflected a strong correlation between the MMSE and RUDAS.

Table 12.



MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

Based on the results from the first study in the Thai population, only a patient's educational level affected performance on the RUDAS.[3] The MMSE, however, was also influenced by a patient's cultural background, age, and language.[3] When looking at the second study in the Australian population, the scores on the tests and the presence of an informant were confounding predictors of dementia.[4] However, when considering MMSE score, dementia presence was also confounded by a patient's CALD status.[4] Finally, in the third study in the Turkish immigrant population, performance on the MMSE was more affected by education level as compared to the RUDAS.[6]

The studies did draw certain conclusions about the performance of the MMSE and RUDAS in diverse populations, but their findings were very limited due to the specificity of their patient populations. To state confidently that either test is superior to the other in accuracy of dementia detection, it is essential to conduct extensive studies in a variety of demographics. Unfortunately, none of the studies included in this review were conducted in the United States. To recommend that fellow practitioners switch to the RUDAS in clinical practice, studies would have to be conducted in a clinical scenario that is like their own. A very useful study would include a multicultural cohort of participants from various backgrounds.

For clinicians who have been using the MMSE for many years and have little or no exposure to the RUDAS, it would seem illogical to switch to an unfamiliar, new assessment. However, the RUDAS takes little time to administer, easily adapts to non-English languages, and performs as well as the MMSE. If the RUDAS were integrated into more clinics and even taught in schools, it could greatly reduce false positives caused by low education or cultural differences. Because there are still few studies comparing the MMSE and RUDAS, it would be prudent to continue research, especially with studies that include additional cultures, older populations, and increased sample sizes.

Application to the patient

Referring to our clinical scenario, the RUDAS is better suited to detect dementia in D.S. as opposed to the MMSE. Since English is not his native language and his educational background is unknown, the RUDAS is a better fit since it is free of the biases of limited education and cultural barriers that the MMSE often exhibits. To best serve the patient and his specific situation, it is in his best interest to use the RUDAS as his dementia assessment.

CONCLUSION

In an increasingly diverse elderly population, is the RUDAS a better tool to detect dementia as compared to the standard MMSE?

Based on the results of the studies in this literature review, the RUDAS is equally proficient at detecting dementia as the MMSE and is less affected by outside variables such as the patient's cultural background, language, and level of education. For those practitioners who serve a diverse patient population, we suggest that the RUDAS replace the MMSE for their clinical assessment of dementia. We cannot conclude that the RUDAS is an overall better tool in all populations, but it is better suited when there are underlying patient demographics that could inappropriately alter the scores of the MMSE.

MMSE: Mini-Mental State Examination; RUDAS: Rowland Universal Dementia Assessment Scale; DSM: Diagnostic Statistical Manual; ROC: receiver operating characteristic; AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; MCI: mild cognitive impairment; GPCOG: General Practitioner Assessment of Cognition; CALD: culturally and linguistically diverse; GDS: Geriatric Depression Scale; MBI: Modified Barthel Index; ASASH: A Short Acculturation Scale for Hispanics

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APPENDIX 1.

Example of MMSE[7]

MINI MENTAL STATE EXAMINATION (MMSE)

Name:

DOB:

Hospital Number:

One point for each answer	DATE:		
ORIENTATION Year Season Month Date Time	...../ 5	...../ 5	...../ 5
Country Town District Hospital Ward/Floor	...../ 5	...../ 5	...../ 5
REGISTRATION Examiner names three objects (e.g. apple, table, penny) and asks the patient to repeat (1 point for each correct. THEN the patient learns the 3 names repeating until correct).	...../ 3	...../ 3	...../ 3
ATTENTION AND CALCULATION Subtract 7 from 100, then repeat from result. Continue five times: 100, 93, 86, 79, 65. (Alternative: spell "WORLD" backwards: DLROW).	...../ 5	...../ 5	...../ 5
RECALL Ask for the names of the three objects learned earlier.	...../ 3	...../ 3	...../ 3
LANGUAGE Name two objects (e.g. pen, watch).	...../ 2	...../ 2	...../ 2
Repeat "No ifs, ands, or buts".	...../ 1	...../ 1	...../ 1
Give a three-stage command. Score 1 for each stage. (e.g. "Place index finger of right hand on your nose and then on your left ear").	...../ 3	...../ 3	...../ 3
Ask the patient to read and obey a written command on a piece of paper. The written instruction is: "Close your eyes".	...../ 1	...../ 1	...../ 1
Ask the patient to write a sentence. Score 1 if it is sensible and has a subject and a verb.	...../ 1	...../ 1	...../ 1
COPYING: Ask the patient to copy a pair of intersecting pentagons 	...../ 1	...../ 1	...../ 1
TOTAL:	...../ 30	...../ 30	...../ 30

MMSE scoring
24-30: no cognitive impairment
18-23: mild cognitive impairment
0-17: severe cognitive impairment

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Example of RUDAS[8]

R U D A S

The Rowland Universal Dementia Assessment Scale: A Multicultural Cognitive Assessment Scale.
(Storey, Rowland, Basic, Conforti & Dickson, 2004). International Psychogeriatrics, 16 (1), 13-31

Date: ____/____/____ Patient **Name:** _____

Item		Max Score
Memory 1. (Instructions) I want you to imagine that we are going shopping. Here is a list of grocery items. I would like you to remember the following items which we need to get from the shop. When we get to the shop in about 5 mins. time I will ask you what it is that we have to buy. You must remember the list for me. **Tea, Cooking Oil, Eggs, Soap** Please repeat this list for me (ask person to repeat the list 3 times). (If person did not repeat all four words, repeat the list until the person has learned them and can repeat them, or, up to a maximum of five times.)		
Visuospatial Orientation 2. I am going to ask you to identify/show me different parts of the body. *(Correct = 1)*. Once the person correctly answers 5 parts of this question, do not continue as the maximum score is 5.		
(1) show me your right foot	1	
(2) show me your left hand	1	
(3) with your right hand touch your left shoulder	1	
(4) with your left hand touch your right ear	1	
(5) which is (indicate/point to) my left knee	1	
(6) which is (indicate/point to) my right elbow	1	
(7) with your right hand indicate/point to my left eye	1	
(8) with your left hand indicate/point to my left foot	1	
		..../5
Praxis 3. I am going to show you an action/exercise with my hands. I want you to watch me and copy what I do. Copy me when I do this . . . (One hand in fist, the other palm down on table - alternate simultaneously.) Now do it with me: Now I would like you to keep doing this action at this pace until I tell you to stop - approximately 10 seconds. (Demonstrate at moderate walking pace). Score as: *Normal* = 2 *(very few if any errors; self-corrected, progressively better; good maintenance; only very slight lack of synchrony between hands)* *Partially Adequate* = 1 *(noticeable errors with some attempt to self-correct; some attempt at maintenance; poor synchrony)* *Failed* = 0 *(cannot do the task; no maintenance; no attempt whatsoever)*		
		..../2
Visuoconstructional Drawing 4. Please draw this picture exactly as it looks to you (Show cube on back of page). *(Yes = 1)* Score as: (1) Has person drawn a picture based on a square?	1	
(2) Do all internal lines appear in person's drawing?	1	
		
(3) Do all external lines appear in person's drawing?	1	
		
		..../3
Judgment 5. You are standing on the side of a busy street. There is no pedestrian crossing and no traffic lights. Tell me what you would do to get across to the other side of the road **safely**. (If person gives incomplete response that does not address both parts of answer, use prompt: "Is there anything else you would do?") Record exactly what patient says and circle all parts of response which were prompted. .... Score as: Did person indicate that they would look for traffic? *(YES = 2; YES PROMPTED = 1; NO = 0)*	2	
Did person make any additional safety proposals? *(YES = 2; YES PROMPTED = 1; NO = 0)*	2	
		..../4

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Memory Recall 1. (Recall) We have just arrived at the shop. Can you remember the list of groceries we need to buy? (Prompt: If person cannot recall any of the list, say "The first one was 'tea'." *(Score 2 points each for any item recalled which was not prompted – use only 'tea' as a prompt.)* *Tea* .....2 *Cooking Oil* .....2 *Eggs* .....2 *Soap* 2		**..../8**
Language 6. I am going to time you for one minute. In that one minute, I would like you to tell me the names of as many different animals as you can. We'll see how many different animals you can name in one minute. (Repeat instructions if necessary). Maximum score for this item is 8. If person names 8 new animals in less than one minute there is no need to continue. 1. ..... 5. ..... 2. ..... 6. ..... 3. ..... 7. ..... 4. ..... 8.		**..../8**
TOTAL SCORE =		**/30**

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