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To cite this article: Amer Jaroshy & Hisham Arab Alkabeya (09 Feb 2024): Test-Re-Test Reliability and Internal Consistency of Rowland Universal Dementia Assessment Scale (RUDAS) among Palestinian Older Adults, Occupational Therapy in Mental Health, DOI: [10.1080/0164212X.2024.2313503](https://doi.org/10.1080/0164212X.2024.2313503)

To link to this article: <https://doi.org/10.1080/0164212X.2024.2313503>



Published online: 09 Feb 2024.



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METHOD



# Test-Re-Test Reliability and Internal Consistency of Rowland Universal Dementia Assessment Scale (RUDAS) among Palestinian Older Adults

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## ABSTRACT

The Rowland Universal Dementia Assessment Scale (RUDAS) is a cognitive assessment suitable for diverse populations. However, the test-retest reliability and internal consistency of the Arabic version of RUDAS were not examined. This study aimed to examine these aspects. The Arabic RUDAS was administered twice to a sample of 37 older adults. The intra-class correlation coefficients and the Kappa coefficient examined the test-retest reliability. The internal consistency of the Arabic RUDAS was assessed using Cronbach's alpha. The RUDAS showed high internal consistency ( $\alpha = 0.866$ ) and test-retest reliability ( $ICC = 0.971$ ), with substantial agreement between tests ( $Kappa = 0.78$ ). The Arabic RUDAS is highly reliable with Palestinian older adults.

## KEYWORDS

Arabic RUDAS; test-retest reliability; internal consistency

## Introduction

The global proportion of the elderly population is increasing rapidly, and the Arab world is no exception. The World Health Organization (WHO) predicts that by 2030 about one in every six people will be 60 years old or older. During this time there will be a change in the population structure with the number of individuals aged 60 and above expected to increase from one billion, in 2020 to 1.4 billion., with the majority living in middle- and low-income countries (WHO, 2021). The number of people aged sixty and above in Palestine reached 257,151 in 2019 (Palestinian Central Bureau of Statistics, 2019).

Cognitive deficits are common among older people affecting more than 8% of the elderly population, and cause a substantial burden on families and caregivers (Khanna & Metgud, 2020).

*Dementia* is a prevalent cognitive deficit characterized by a substantial decline in one or more cognitive domains that impairs an individual's

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ability to perform daily activities independently (American Psychiatric Association, 2013). Worldwide, WHO indicated that over 55 million people are affected by dementia, most of whom reside in low- and middle-income countries. Additionally, dementia ranks as the seventh leading cause of death and significantly contributes to disability and dependency among the elderly population globally (WHO, 2023). A longitudinal study has indicated that cognitive impairment without dementia could be more prevalent than dementia among individuals aged 71 years or older in the United States (Plassman et al., 2008). Therefore, early screening and diagnosis of cognitive deficits are vital to initiate timely interventions (Nielsen et al., 2013).

Assessing cognitive abilities is a fundamental aspect of clinical practice in mental health and occupational therapy. Cognitive assessments are primarily used to screen for cognitive impairment, differentiate disease causes, rate cognitive deficit severity, and monitor disease progression (Woodford & George, 2007). Various assessment tools have been developed to support clinicians and researchers in this process, varying from brief screening tools to formal neuropsychological assessments. The selection of an appropriate tool depends on several factors, such as the available time and the assessment's purpose. Considering time constraints in primary care settings, many of these instruments are brief screening tools (Petersen & Yaffe, 2020).

The United States Preventive Services Task Force (USPSTF) reported that the Mini-Mental State Examination (MMSE) is the most commonly used instrument in detecting dementia (Owens et al., 2020). However, most available cognitive tests, including MMSE, are designed for English speakers in Western cultures, such as Europe and North America, and were standardized on white male outpatients (Mirza et al., 2023). Since language and culture could influence an individual's comprehension and response to cognitive tests, identifying cognitive deficits among non-westerners and non-English speakers' older individuals is challenging (Davis et al., 1996; Mirza et al., 2023). Moreover, most cognitive assessment tools are influenced by people's age, language, education, and ethnic background (Nielsen et al., 2013). Consequently, the available and commonly used cognitive diagnosis and screening assessments might lack cultural appropriateness (Clarkson et al., 2012).

In light of the above-listed shortcomings of the available cognitive assessment tools, the Rowland Universal Dementia Assessment Scale (RUDAS) was developed (Storey et al., 2004) (Table 1). The components of RUDAS are free from the influence of cultural or linguistic variations and are not specific to a few cultures or languages. This 6-item tool was developed to identify cognitive deficits in diverse cultural and linguistic populations and

**Table 1.** The rowland universal dementia assessment scale.

Cognitive domain	Question	Points
Registration	Given 4 grocery items (tea, cooking oil, eggs, and soap) to register (and recall later).	0 points
Visuospatial orientation	Left/right orientation with body parts	Involving the identification of 8 different body parts, achieving a maximum score of 5 points requires only five correct responses
Praxis	Alternating hand movements with fist and palm	This task is assessed as either normal (2 points), partially adequate (1 point), or failed (0 points)
Visuoconstructional drawing	Copying image of a cube	To achieve a maximum score of 3 points in cube copying, three components are required: drawing based on a square, all of internal and external lines are drawn.
Judgment	Safety precautions when crossing a street	Checking for traffic and an extra safety response both earn 2 points without providing prompts.
Memory recall	Recalling 4 grocery items from above	2 points are given for each correct response (maximum score is 8 points, however 6 points are given in case of using prompts)
Language	Animal naming in 1 minute	Despite having a minute to name as many animals as possible, achieving a maximum score of 8 points only requires naming 8 animals.

has acceptable psychometric properties (Storey et al., 2004). This tool's original validation and reliability study reported that the RUDAS has very good reliability, including interrater reliability (ICC = 0.99) and test-re-test reliability (ICC = 0.98). Sensitivity and specificity were tested in the original study and reported to be excellent (89% and 98%, respectively) (Storey et al., 2004).

RUDAS was cross-culturally validated in many languages, such as Turkish (Ayan et al., 2019) and Arabic (Chaaya et al., 2016). The Turkish validation study reported that the RUDAS has an acceptable internal consistency (Cronbach alpha = 0.692). In addition, reliability using the Split Half method (Measuring the consistency of a test's scores (Frey, 2018)) was 35.6% for the first half and 61.7% for the other half of the test. When any item of the RUDAS was deleted general Cronbach value was lower; therefore, it concluded that all RUDAS items are consistent and have positive contributions (Ayan et al., 2019).

The Arabic RUDAS was validated in Lebanon and reported to have good internal consistency (Cronbach alpha = 0.87). However, the reliability of the Arabic RUDAS was not examined (Chaaya et al., 2016).

The Consensus-based standards for the selection of health status measurement instruments defined reliability as “the degree to which the measurement is free from measurement error” (Mokkink et al., 2010). Examining test-retest reliability is crucial for a performance-based measure with observational ratings to verify measurement error (Portney, 2020). Test-retest reliability is concerned with consistency when repeating the test

on the same individual at different time points. The intraclass correlation coefficients (ICC) is the most appropriate and most commonly used reliability parameter for continuous measures, whereas for ordinal measures, the weighted Cohen's Kappa coefficient should be used. Internal consistency is concerned with the interrelatedness of the items and the homogeneity of the scale. Cronbach's alpha is a commonly used statistical method for estimating internal consistency reliability based on the function of the average inter-correlation of the items and the number of items in the scale (Terwee et al., 2007).

Through evaluating the reliability of the Arabic version of the RUDAS, its potential can be verified for being applied in mental health assessments and interventions. This will serve as a valuable resource to identify and track cognitive deficits by occupational therapists providing mental health services for older adults. The results of this study will add to the growing body of research in the field of occupational therapy and mental health, with the ultimate goal of enhancing the care provided to Arabic speaking older individuals facing cognitive challenges. Therefore, this study aimed to examine the reliability of RUDAS among older Palestinian adults.

## **Methods**

### ***Study design***

This study is a cross-sectional study. A cross-sectional design is appropriate for investigating outcome measures' validity and reliability (Kesmodel, 2018).

### ***Study setting***

This study was conducted in Jenin district retirement institutions. This setting was selected because it is accessible for the researchers and is one of the highly populated regions in Palestine. These retirement institutions are located in northern Palestine and serve Jenin City and its surrounding areas, providing various services to the local population.

### ***Sample size***

The sample size requirement for an intra-class correlation (ICC) test in the present study was derived from the formula of the ICC test using a web-based sample size calculator created by Arifin (2023) with a fixed alpha level of 0.05 and a power of 90%. The analysis indicated that a minimum sample size of 36 would be sufficient to detect an ICC value of 0.50. The

calculated sample size was increased by 10% (to compensate for dropout), resulting in 40 participants.

### ***Participant recruitment***

Participants were included in the study if they were

1. Aged 65 years or older,
2. Did not have any disabilities or acute critical diseases (e.g., pneumonia, stroke, and myocardial infarction) preventing the application of RUDAS, and
3. Did not have any major psychiatric disorder documented in their medical records.

However, participants were excluded if they

1. Have been diagnosed with mental illness that may alter the overall assessment outcome,
2. Had severe visual impairment (e.g., low vision, macular degeneration, and cataracts) that may affect the drawing item of the assessment,
3. Had a severe auditory impairment (e.g., tinnitus, and conductive hearing loss) that may affect following the standard assessment procedure,
4. Had physical impairment that may hinder participating in tasks such as fist-palm alternation, and
5. Had medical instability or delirium.

It's worth mentioning that the above inclusion and exclusion criteria were assessed through a comprehensive review of the participants medical records. A convenience sample procedure was employed to recruit the present study participants. Convenience sampling design is a widely used method to enroll participants according to their availability and accessibility (Elfil & Negida, 2017).

Participants were recruited through a collaborative effort by service providers at retirement institutions. Researchers provided detailed information to service providers regarding the study goals, process, and inclusion/exclusion criteria. Service providers were asked to give the recruitment pack to the individuals who met the inclusion criteria. Participants had at least two days to decide whether or not to participate. In order to participate in the study, participants had to contact the service providers at retirement institutions, and the service providers connected the participant with the researchers via a work phone. Using the inclusion and exclusion criteria as a checklist, the researcher assessed the eligibility of potential participants during the phone

call. This phone call allowed participants to ask any questions about the study. At the end of the phone call, eligible participants verbally consented to participate. Eligible participants were invited to two data collection sessions. All participants underwent an initial evaluation in the first week of April 2022, followed by a second assessment two weeks later, lasting one week. The duration between the first and second assessments was consistent at two weeks for all participants. This approach was adopted to ensure that each individual involved in the study had a standardized and consistent time interval between evaluations. All assessment sessions were conducted in the rehabilitation units located within participants' retirement institutions.

## **Data collection**

### ***Sociodemographic data***

Sociodemographic information was collected from the participants using a sociodemographic questionnaire. The participants' educational level, age, marital status, and gender were included in this questionnaire. This section also included sociodemographic questions such as living arrangements, living area, and economic status.

### ***The RUDAS***

RUDAS measures the cognitive ability of people from diverse backgrounds. It consists of six items (Table 1) (Naqvi et al., 2015), including memory, praxis, body orientation, language, drawings, and judgment evaluated by the RUDAS. Additionally, it can be used to assess impairments in executive function (Iype et al., 2006). RUDAS's total score is 30 points, and the recommended cutoff value is 21 (Custodio et al., 2019).

### ***Data collection procedure***

Data collection sessions were held at rehabilitation units within the retirement institutions. Upon arrival at the rehabilitation unit, the researchers provided all participants with information about the research aims and the procedure. Participants were then invited to raise any concerns and ask questions regarding the procedure. Following informed consent, Participants were asked to complete or assist with completing the sociodemographic questionnaire. After completing the sociodemographic questionnaire, the first author administered the RUDAS assessment. He is a qualified occupational therapist registered with the Palestinian Ministry of Health, with substantial experience assessing cognitive abilities among older adults. He had also successfully passed a special training to conduct

RUDAS from Fairfield Hospital in Sydney, Australia. Standardized data collection instructions were followed for the RUDAS assessment (Storey et al., 2004). Participants were invited to the second data collection session in two weeks to perform the re-test assessment.

### ***Statistical analysis***

#### ***Descriptive statistics***

Data analysis was performed using SPSS software (Statistical Package for Social Sciences version 26). Descriptive statistics were used to present continuous data using the mean and standard deviation. Frequencies and percentages were used to present categorical data.

#### ***Test-retest reliability***

To assess the reliability of the measurement scales, the intraclass correlation coefficients (ICC) are recommended (Mokkink et al., 2010). In the current study, the 2-way mixed-effects model ICC was computed since it is appropriate for testing several scores for one rater. ICC result was interpreted as follows: "values  $< 0.5$  as indicating poor reliability, and  $\geq 0.5 - < 0.75$  as moderate reliability,  $\geq 0.75 - < 0.9$  as good reliability,  $> 0.9$  as excellent reliability" (Koo & Li, 2016).

To further explore the test-retest reliability of the Arabic RUDAS, continuous data were transformed into two categories (i.e., with/without cognitive deficit) using the established cutoff point of the RUDAS (Custodio et al., 2019) and Cohen's kappa was computed. Kappa result was interpreted as follows: "values  $\leq 0$  as indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement." (McHugh, 2012).

#### ***Internal consistency***

The internal consistency of the Arabic RUDAS was assessed using Cronbach's alpha, which equals the average inter-correlation of the items and the number of items in the scale (Terwee et al., 2007). A value greater than 0.7 was considered acceptable (Frey, 2018).

### **Results**

The characteristics of the sampled participants are displayed in Table 2. This study included 19 males and 18 females with a mean age of 74.6 years. The majority of the participants had no formal education (59.5%). Baseline data showed that among the 37 participants, 22 had no cognitive deficit, and 15 showed cognitive deficit.



### **Test-retest reliability and internal consistency of the RUDAS**

The test-retest reliability was excellent for the total score ( $ICC = 0.971$ ). The ICC for subtests score ranged from moderate to excellent ( $0.640 - 0.971$ ) (Table 3). Based on the cutoff value of the RUDAS, participants were classified as with/without cognitive deficits. Accordingly, the Cohen's Kappa coefficient was used further to explore the test-retest reliability of the Arabic RUDAS. A kappa value of 0.78 was found between the test and re-test, which suggests a substantial strength of agreement. This kappa value is significantly different from zero ( $\kappa=0.78, p < 0.001$ ).

The Arabic version of the RUDAS showed very good internal consistency (Cronbach alpha = 0.866). The Alpha value remained good (range = 0.817–0.867) if single items were deleted, indicating no individual item substantially lowered the scale's internal consistency (Table 4).

### **Discussion**

This study aimed to explore the test-re-test reliability and internal consistency of the Arabic RUDAS among older Palestinian adults. Data were collected from a convenient sample ( $n=37$ ) of older people living in the northern region of Palestine. For the present study sample, the results showed that the Arabic version of the RUDAS has very good internal consistency (Cronbach alpha = 0.866). When one of the items was removed, Cronbach's alpha coefficient was decreased, which illustrates that each item (except praxis) uniquely contributed to the overall conceptual framework of the RUDAS. These results align with the previous literature, including a Lebanese study that reported good to very good internal consistency of the RUDAS (Cronbach alpha range = 0.77-0.87) (Chaaya et al., 2016). However, internal consistency for the Portuguese and Spanish versions of the RUDAS was reported to be weak (Cronbach alpha = 0.54 and 0.65, respectively) (Custodio et al., 2019; de Araujo et al., 2018). Differences in

**Table 2.** The baseline demographic and clinical characteristics of the participants.

Variable	Mean (SD)	n (%)
Age	74.6 (6.2)	
Gender		
Male		19 (51.4)
Female		18 (48.6)
Level of Education		
No formal education		22 (59.5)
Formal education		15 (40.5)
RUDAS score	19.6 (4.6)	
Cognitive ability <sup>a</sup>		
with cognitive deficit	16.6 (3.1)	15 (40.5)
without cognitive deficit	24.1 (2.2)	22 (59.5)

<sup>a</sup>Cognitive ability classification was based on the cutoff value of the RUDAS (Normal  $\geq 21$ , Deficit  $\leq 20$ ) (Custodio et al., 2019).

**Table 3.** The Intraclass Correlation Coefficient of the RUDAS subtest scores and total RUDAS scores.

RUDAS subtests	Intraclass Correlation (95% Confidence Interval)	<i>p</i> Value
Body orientation	0.670 (0.349;0.833)	<0.001
Praxis	0.640 (0.311;0.815)	<0.001
Drawing	0.953 (0.909;0.976)	<0.001
Judgment	0.926 (0.862;0.961)	<0.001
Memory	0.898 (0.811;0.946)	<0.001
Language	0.911 (0.811;0.956)	<0.001
Total score	0.971 (0.721;0.991)	<0.001

**Table 4.** Item-total statistics.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
body orientation	15.19	17.269	0.610	0.855
Praxis	18.70	18.826	0.612	0.867
Drawing	18.32	15.003	0.775	0.824
Judgment	17.27	16.314	0.613	0.851
Memory	14.51	11.423	0.835	0.817
Language	13.97	13.027	0.758	0.827

methodological approaches, patients' characteristics, and sample size might explain the variation in the reported results. However, the cultural sensitivity of the RUDAS should be explored in future research.

The present study showed that the Arabic RUDAS has excellent intra-rater reliability with absolute agreement and a 95% confidence interval of 0.971(0.721,0.991). Thus, it is appropriate to assume that the Arabic RUDAS reliability level ranges from good to excellent. This is in accordance with the previous studies, which reported ICC values greater than 0.9 (Ayan et al., 2019; Custodio et al., 2019; Storey et al., 2004). Considering the cutoff value of the RUDAS, the analysis of this study has uniquely computed a kappa value to explore the agreement between the baseline and re-test of Arabic RUDAS. The current study showed a substantial ( $\kappa=0.78$ ) agreement between the baseline and re-test. However, preceding literature provided different cutoff points for the RUDAS (Custodio et al., 2019; Limpawattana et al., 2012; Storey et al., 2004), which suggest that the RUDAS could be influenced by educational level (Limpawattana et al., 2012). Custodio et al. (2019) recommended that a cutoff value of  $\geq 21$  should be used with low-educated older adults. In the present study, more than half of the participants (approximately 60%) had no formal education. Therefore, the cutoff value of  $\geq 21$  was reasonable to be used in the current study.

The current analysis has uniquely presented ICC for each item of the RUDAS. Most of the RUDAS items showed relatively excellent ICC values except for the body orientation and praxis, which showed moderate ICC values (ICC =0.670, ICC = 0.640, respectively). It is well documented in the literature that the "practice effect" (improvement in cognitive test score when a test is repeated due to multiple factors, such as exposure to

cognitive test, prior familiarity, and the examiner) could influence the cognitive test score (Calamia et al., 2012). In the present study, 27% of the participants had improvements in body orientation and praxis scores in the second administration. Therefore, it is anticipated that factors (e.g., participants' age, length of re-test interval) associated with practice effect may influence the present study results. Research is timely and warranted to explore the practice effect factors that may influence RUDAS scores.

This study demonstrated an acceptable test-retest and internal consistency propriety of the Arabic RUDAS, which holds promising implications for occupational therapists and mental health practitioners working with Arabic-speaking adults. Accordingly, occupational therapists and mental health practitioners can confidently utilize this reliable screening tool within this population. Occupational therapists could use the Arabic RUDAS to assess and inform targeted interventions to enhance daily living skills and improve overall mental well-being. However, the present study showed a variation in item-specific reliability of the Arabic RUDAS (i.e., body orientation and praxis), which indicates the importance of considering potential practice effects and other factors influencing cognitive test scores. These findings necessitate that occupational therapist should tailor their interventions to address cognitive impairments among Arabic-speaking older adults, considering the cultural and educational background as a significant influencing factor. Future research investigating the cultural sensitivity of the Arabic RUDAS in mental health settings with a specific focus on the impact of practice effects on cognitive scores can provide valuable insight for improving assessment and therapeutic interventions in the geriatric mental health field.

## **Limitations**

There are a few limitations that should be discussed. The small sample size may have influenced the results of this study. Research participants were recruited using a convenience sampling method. As a result, some groups of the Palestinian elderly population may have been under- or over-represented in the sample, and the generalizability of the findings beyond the samples is limited. Furthermore, the participants in this cross-sectional study were recruited from the northern region of Palestine; thus, the sample may lack the representation of the Palestinian elderly population. This research was conducted in a developing country setting, and therefore the transferability of the findings may be limited to other contexts considering the differences in the sociocultural background. However, the current study's results agree with most of the published literature. Inter-rater reliability of the Arabic RUDAS was not examined in the current study. Therefore, future research should explore this important reliability by

employing a reasonable sample size. The final recommendation is that future research should examine another parameter of an agreement by using Bland and Altman (Terwee et al., 2007).

## Conclusion and implications

To the authors' knowledge, this is the first study that provided evidence for the reliability of the Arabic RUDAS among Arabic speaking older adults. This study indicated that the Arabic RUDAS has very good internal consistency and intra-rater reliability. Further research is required to explore other aspects of the psychometric properties (e.g., validity, sensitivity and specificity) of the Arabic RUDAS. Instead of the commonly used outcome measures such as the MMSE, RUDAS can be used for screening and research purposes. This will facilitate widespread utilization of the Arabic RUDAS in occupational therapy and mental health practice worldwide, specifically among populations with Arabic backgrounds. However, this conclusion should be treated carefully since this study included a small convenient sample from one geographical region of Palestine.

## Author contributions

All authors demonstrated their collaborative accountability in this research project by contributing equally to the conception, design, data analysis, manuscript drafting, critical revisions, and final approval for publication.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

The author(s) reported there is no funding associated with the work featured in this article.

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