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Lebanese Arabic Adaptation of the Quick Aphasia Battery: A Psychometric Evaluation

Studies into language impairments among Arabic-speaking adults remain scarce, and the field of aphasiology understudied; this is in part due to the lack of standardized assessment tools that can identify and assess patients suspected to have aphasia. Since the Quick Aphasia Battery (QAB) is characterized by its speed and comprehensiveness, it was selected for an adaptation into Lebanese Arabic. A preliminary data collection was first conducted on a pilot healthy sample which motivated the change of a few test items deemed to be culturally inappropriate. The revised version was then administered to a sample of healthy controls (HC) participants (N = 132) and post-stroke aphasic individuals (N = 30). The adapted QAB was shown to be a reliable assessment tool with high sensitivity and specificity for the diagnosis of aphasia

Key words: QAB, aphasia, adaptation, Lebanese Arabic, language

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Background

Neuropsychological findings show that language as a cognitive function is mostly determined by activity from the left cerebral hemisphere for the great majority of people (Roby-Brami, Hermsdörfer, Roy, & Jacobs, 2012). Therefore, any complication afflicting the left hemisphere could potentially result in language alteration or disruption, with aphasia being one such impairment (Benson, 1986; Goodglass, 1993).

The prevalence of stroke was reported, after adjusting the rate, as 182 per 10,000, or 1.82% in the EU in 2017 (Wafa et al., 2020), and as 2.9% in the USA in 2020-2022 (Imoisili et al., 2024). Aphasia among stroke survivors in developed countries was reported in 21-38% of acute stroke patients, 30-34% of those who had a mixed stroke (ischemic and hemorrhagic), 62% among those who survived acute ischemic strokes upon reaching the hospital no more than three hours from stroke onset, and 9% among those who suffered from subarachnoid hemorrhagic strokes (Berthier, 2005; Flowers et al., 2016). In Lebanon, a developing country, it was found that there was a high prevalence rate of stroke, with one age-adjusted prevalence of Lebanese stroke survivors reported as high as 0.5% (Lahoud, Salameh, Saleh, & Hosseini, 2016). While there has been no study as of yet that measured the prevalence of Lebanese stroke survivors who actually develop aphasia, it can be assumed that many of them do.

Furthermore, it has been reported that people with aphasia (PWA) were at a higher risk to develop depression and social exclusion, and that they had lower levels of leisure, social contacts, and quality of life, with 70% of the stroke population who develop aphasia meeting the DSM-III-R criteria for depression at 3 months and 62% at 12 months (Baker et al., 2018). Loss of the everyday function of language, which in turn impedes communication-dependent activities and limits complex social activities, contributes to these feelings of exclusion (Spaccavento et al., 2013). In one study that conducted semi-interviews with individuals with aphasia, it was found that the individuals experienced feelings of being left out despite once being the talkers of their social circles (Dalemans et al., 2010). Considering that aphasia not only has debilitating effects on the patient in terms of language-function, but also in their long-term quality of life, it is essential to detect and assess it quickly and efficiently in order to draw out a map for rehabilitation.

Neurorehabilitation in Lebanese hospitals oftentimes employ informally translated language assessment tools for post-stroke patients manifesting aphasic symptoms, and even then, it is not routinely and consistently done. This, in turn, necessitates the development of a standardized, quick and accurate tool to facilitate and encourage the process of language assessment.

In parts of the Arabic-speaking world, Lebanon included, language impairment is usually assessed using informal tests and materials translated into the local vernacular, with minimal modifications to make the test more culturally-sound (Khwaileh & Grosvald, 2019). There are as many as 300 million people today who

speak Arabic, making it out of the most widely spoken languages in the world. However, Arabic itself is a macrolanguage comprising over thirty varieties that present enough variation that people from different parts of the Arabic-world may face difficulty understanding one another and instead resort to Modern Standard Arabic, the learned Arabic of education and media (Horesh & Cotter, 2016).

Studies that probe specific characteristics of post-stroke linguistically-compromised Arabic speakers are scarce. However, two studies that investigated agrammatism manifestations in Jordanian (Albustanji et al., 2013) and Palestinian Arabic (Adam, 2023) – two varieties closely related to Lebanese Arabic, all belonging to the Levantine Arabic dialectal continuum – show that wh-question production is more impaired compared to yes/no questions since the former involves the movement of the wh-morpheme as opposed to a change of intonation that marks the latter. Furthermore, tense inflections were found to be more impaired when compared to the production of agreement inflections and negation particles. Jordanian Arabic agrammatism also reveals that the perfective tense form was more impaired than the imperfective which point towards tense vulnerability in Jordanian Arabic. It can be hypothesized that Lebanese Arabic will be affected similarly since conjugation and question-formation in Lebanese Arabic is consistent with its Levantine sister dialects (Albustanji et al., 2013).

It is important, then, to first acknowledge the cultural and linguistic nuances of different Arabic-speaking populations in the development of an aphasia assessment tool. Language impairments may not be adequately captured if the test is not culturally and linguistically sensitive enough, and in order to achieve a more accurate diagnosis, factors like dialectal variations, language structure and cultural norms need to be factored in (Ivanova & Hallowell, 2013). Arabic varieties that form the Levantine Arabic subgroup are typically viewed as being very similar in their morphosyntax and lexis; however, enough cultural factors surround these varieties, that using one aphasia assessment tool for all varieties would be advised against. Lexical choice is perhaps the most pertinent presentation of cultural differences in those varieties, and one word that may be of high frequency in one variety, can be completely unfamiliar to the speakers of the other variety.

Furthermore, adapting or developing language assessment tools for Arabic-speaking populations must take into account the diglossia phenomenon in the Arabic-speaking world. For everyday communication, as well as in informal writing, dialectal Arabic is used, and this is unique and is spread along a dialectal continuum spanning West Asia from Iraq to Mauritania in North Africa. The dialectal varieties of Arabic are thus acquired as the Arabic speakers' first language, while the standardized variety of Arabic, Modern Standard Arabic (MSA), is acquired through education (Abu Kwaik et al., 2018). This presents a challenge since language assessment tools often test skills like reading and writing, and for Arabic speakers, these two skills are closely linked to MSA, the formal language of reading and writing. While writing in dialectal Arabic has become more common, a standardized writing system for any Arabic dialectal variety is yet to be developed.

Therefore, any language assessment tool for any Arabic-speaking population has to reconcile between dialectal Arabic and MSA in order to efficiently examine the language skills of the Arabic speaker.

Movement towards adapting aphasia assessment tools for Arabic speakers that take into account the linguistic, cultural, and religious nuances of the local varieties, and efforts on this front have recently picked up the pace with several tests already developed and standardized for post-stroke patients whose native language is an Arabic variety. These include: the Bilingual Aphasia Test for Palestinian Arabic speakers (Ivanova & Hallowell, 2013), the Mansoura Arabic Screening Aphasia Test (MASAT; Abou-Elsaad et al., 2018), The Comprehensive Aphasia Test (CAT; Abou El-Ella et al., 2013), the short aphasia test for Gulf Arabic speakers (SATG; Altaib et al., 2021), and the Moroccan Arabic Token Test (MATT; Rami et al., 2021). As for Lebanese Arabic, two tools were found to have been culturally and linguistically adapted into the local variety. They are: the bedside version of the Arabic Diagnostic Aphasia Battery (A-DAB-1; Al-Thalaya et al., 2018), and the Bilingual Aphasia Test (BAT) – the short version (Ezzeddine, 2017). The latter, however, is yet to be validated on an aphasic sample.

The Quick Aphasia Battery, which is another assessment tool, takes into account in its design the research done on the neuroplasticity of the language networks of the brain after insult of the language-related cerebral areas. Three criteria form the framework basis upon which the QAB was designed: it had to be time-efficient and bedside administrable, psychometrically sound in that its inter-rater reliability and test-retest reproducibility had to be good, and descriptive enough in that it provides a multidimensional understanding of the intact and of the impaired aspects of language and speech functions (Wilson et al., 2018).

The QAB was elected for an adaptation and translation into Lebanese Arabic because to this day there is a paucity of effective aphasia assessment tools tailor-made for speakers of Lebanese Arabic. Efforts into validating and standardizing this tool have the benefit of supplanting the use informally translated alternatives that are neither culturally sensitive nor validated with an aphasic sample. Additionally, the QAB offers a more comprehensive alternative to the other available Lebanese Arabic tool, namely A-DAB-1, as it looks into domains of language production that the other do not, while taking similar time to administer. It also tests the patients' reading capacities and includes in its subtests semantic and phonological foils, sentences and words that increase in complexity (where appropriate), and a speech motor programming section that investigates dysarthria and apraxia. The QAB assesses language production and comprehension across seven subtests, namely Connected Speech, Word Comprehension, Sentence Comprehension, Picture Naming, Repetition, Reading Aloud, and Motor Speech while requiring an average of 15 minutes to administer. The A-DAB-1 is structured around six subtests, Content of Descriptive Speech, Fluency of Descriptive Speech, Auditory Comprehension, Complex Auditory Commands, Repetition, and Naming. The QAB merges the first two subtests of the A-DAB-1 into its assessment of the speech produced in its

subtest, the Connected Speech, in addition to assessing other speech features. The QAB also presents different levels of foils and difficulties in its subtests, makes use of words of different levels of frequency for the Naming test, as opposed to the A-DAB-1 which requires the respondent to name 20 high-frequency real objects in its Naming test. Additionally, the scoring system of the QAB is highly structured and organized which allows for a more descriptive analysis of each individual case and a subsequent diagnosis of the type of aphasia manifested.

Finally, the QAB distributes different weights for its subtest items according to their impact and influence in identifying aphasia severity and type, and this in turn affects how the final value is calculated (Wilson, 2018). Contrastively, the A-DAB-1 operates on a score of 60 where each of its subtest awards 10 points.

The quickness and effectiveness of QAB allows for early detection and identification of aphasia, its type and the language functions mostly affected at the acute stage. This in turn, allows for a clearer roadmap to individual rehabilitation and, subsequently, the potential improvement of the quality of the lives of those affected.

The Current Study

The study addresses the need for an aphasia assessment tool for a Lebanese Arabic-speaking population by adapting the Quick Aphasia Battery for use in Lebanon. The QAB was chosen for a cultural and linguistic adaptation and translation since it allows for a quick and comprehensive assessment of post-stroke language-impaired individuals. A Lebanese-Arabic QAB would also prove beneficial in treatment contexts as it could provide a means to follow up on a treatment's efficacy. Furthermore, the QAB can fulfill its original role in assisting in aphasiology-related researches such as studies that look into agrammatism and dysprosody, replacing the informal, translated alternatives.

A cross-sectional study design was used in which a healthy sample of the Lebanese Arabic-speaking population was assessed first using the adapted QAB, followed by a sample of post-stroke individuals who developed aphasia.

Ethical Consideration

The study was conducted and the samples collected and interviewed upon receiving the approval from the Neuroscience Research Center Committee and the Institutional Review Board (IRB) of the Rafik Hariri University Hospital. The study time-frame was from August 2019 to April 2020. Furthermore, consent forms were presented to all respondents and detailed to them or to their caregivers, in case there was a severe impairment in language comprehension or in reading.

Participants

The healthy sample for this study was selected through convenience sampling, by inviting individuals encountered randomly to participate after taking their consent. Following the guidelines proposed by Ivanova and Hallowell (2013),

Table 1. Demographic Characteristics of Participants

Participants/ characteristic	Healthy Controls (HC) (n = 132)	Participants with Acute Aphasia (n = 12)	Participants with Chronic Aphasia (n = 18)	Total Participants with Aphasia (PWA) (n = 30)
Gender n (%)				
Male	65 (49.2)	6 (50)	10 (55.6)	16 (53.3)
Female	67 (50.8)	6 (50)	8 (44.4)	14 (46.7)
Age mean (SD)*	45.92 (17.48)	60.08 (11.35)	63.89 (11.38)	62.37 (11.29)
*Educational Level** n (%)*				
Basic	23 (17.4)	4 (33.3)	7 (38.9)	11 (36.7)
Intermediate	35 (26.5)	2 (12.6)	5 (27.8)	7 (23.3)
Secondary	37 (28)	3 (25)	3 (16.7)	6 (20)
Higher	37 (28)	3 (25)	3 (16.7)	6 (20)
Region n (%)				
Beirut	27 (20.5)	3 (25)	4 (22.2)	7 (23.3)
Mount Lebanon	23 (17.4)	2 (16.7)	1 (5.6)	3 (10)
South	31 (23.5)	4 (33.3)	5 (27.8)	9 (30)
North	30 (22.7)	1 (8.3)	5 (27.8)	6 (20)
Beqaa	21 (15.9)	2 (16.7)	3 (16.7)	5 (16.7)
Second Language n (%)				
Monolingual	34 (25.8)	5 (41.7)	6 (33.3)	11 (36.7)
Bilingual	98 (74.3)	7 (58.3)	12 (56.7)	7 (63.3)
English	55 (41.7)	3 (25)	3 (16.7)	6 (20)
French	43 (32.6)	4 (33.3)	9 (50)	13 (43.3)
Handedness n (%)				
Left	15 (11.4)	0 (0)	2 (11.1)	2 (6.7)
Right	117 (88.6)	12 (100)	16 (89.9)	28 (93.3)

a sample of healthy adults from the community was selected; furthermore, a minimum sample size of N ≥ 100 was strived for. In total, 132 adults were recruited from all regions in Lebanon (Beirut, the South, the North, Mount Lebanon and the Beqaa valley), with ages ranging from 18 to 86. The inclusion criteria for the healthy sample were as follows: (1) aged between 18 and 90; and (2) fluent and literate in Arabic, while participants were excluded if they were: (1) speakers of a variety other than Lebanese Arabic or whose native language is not Arabic (e.g., Armenian).

As for the aphasic sample, it was recruited through different methods. The study was first approved by the IRB of the Rafik Hariri University Hospital before approaching any patient. Patients who had suffered a stroke and were admitted to the hospital were given a week to rest and recover before being asked to partake in the study. Additionally, speech therapy clinics were contacted, and they referred some of their patients who were willing to participate to the researchers. These patients were then interviewed inside their own homes due to COVID-19 constraints during the time.

Following Wilson's original criteria (Wilson et al., 2018), the inclusion criteria for the PWA group were decided to be: (1) aged 18 to 90 and Lebanese-born; (2) fluent and literate in Arabic pre-stroke; and specifically for the acute group (3) stroke confirmed on CT or diffused weighted MRI, and (4) adequately medically stable to complete the QAB within seven days after the stroke. Also similar to Wilson's criteria, the exclusion criteria were: (1) having dementia or suffering from impaired language functions at baseline for reasons unrelated to stroke; (2) having major psychiatric disorders; (3) suffering from substance abuse or withdrawal; and a fourth criterion specific to this study (4) speaking any other variety of Arabic or another language (e.g. Armenian) as their first language.

Ultimately, a total of 30 participants with aphasia were included in the study. Of the total people with aphasia (PWA) participants, 12 patients had acute aphasia while 18 had chronic aphasia. For the former group, the acute stroke was confirmed through CT or diffusion weighted MRI and the patients were diagnosed with aphasia based on the clinical impressions by their physician and the researchers by asking them to produce spontaneous speech which was assessed for articulation, fluency, dysarthria, and paraphasias. For the chronic group, they were accessed through speech rehabilitation centers and visited in their own homes after taking consent; these patients had persistent aphasia regardless of etiology and were diagnosed by their speech therapists using informally translated aphasia assessment tools. Of 18 participants in this group, 15 participants were evaluated twice with the QAB within a two-week interval to determine the test-retest stability of this measure.

Prior to the administration of the QAB, participants were asked to provide sociodemographic information such as gender, age, handedness, second language proficiency, level of education, and region of origin. The means and percentages for these variables are reported in Table 1

Table 2. QAB Summary Measures and their Calculation Formulas

Summary Measure	Calculation
Word Comprehension	Word comprehension total, corrected for chance by subtracting 8 and clipping at 0; denominator is now 24
Sentence Comprehension	Sentence comprehension total, corrected for chance by subtracting 8 and clipping at 0; denominator is now 24
Word Finding	60% Picture Naming Tool
	20% Connected speech: Anomia
	20% Average of Connected speech subtest: Empty speech, Semantic paraphasias, and Phonemic paraphasias, but capped so as not to exceed Anomia
Grammatical Construction	40% Connected speech subtest: Agrammatism
	20% Connected speech subtest: Reduced length and complexity
	20% Connected speech: Paragrammatism, but capped so as not to exceed Agrammatism
	20% Average of sentence items from repetition and reading subtests
Speech motor programming	Motor speech: Apraxia of speech
Repetition	Repetition total
Reading	Reading aloud total

Measures

The Quick Aphasia Battery

The QAB (Wilson et al., 2018) is composed of eight subtests that assess different language domains. The first subtest (Level of consciousness), which does not contribute to the QAB final score, looks into whether or not the patient is sufficiently medically stable to be approached and whether or not the patient is responsive by first asking the patient questions that probe into orientation to place, time and person (e.g. What month is it?). The patient is then asked to follow simple commands such as Close your eyes, followed by a modeling of the action if the patient does not follow the command. Finally, the examiner makes a subjective assessment whether the patient can stay awake and if they are able to maintain attention and follow commands, and proceed accordingly with a complete halting of the assessment if the patient was found not responsive.

Subtests (2) to (8) contribute to the scoring of the QAB summary measures. The scores are based on the participant's speed and accuracy in responding to questions or commands, and the subtests are designed to provide a comprehensive evaluation of language abilities. These subtests involve:

(2) Connected speech which involves conversing with the patient for three to five minutes on any topic, with the QAB offering several examples such as: your first job,

worst trip you've been on, when you had your first baby, etc. This is followed by two images depicting transitive actions which the patient is asked to describe. These instances of connected speech as well as further, spontaneous instances throughout the assessment guide the scoring which uses a 5-point scale assigned to ten features of connected speech such as reduced speech rate, agrammatism, paragrammatism, anomia, empty speech, etc.

(3) Word comprehension which sees the patient's ability to connect word forms with their referents in image form by asking the patient to point to the image of the word the examiner says. This subtest is further divided into two subsections: the first which includes two groups of three images each that are semantically related (e.g. three images of animals including a horse, giraffe and a lion), and a second subsection which shows images of phonologically related words (e.g. ʕalam 'flag', alam 'pencil' and ʕa:lim 'scientist'). These two subsections examine present semantic and phonological foils.

(4) Sentence comprehension which sees the patient answering 13 yes-no questions which fall into four categories: simple situational questions (Are you a man?), simple questions about typical instruments (Do you open the door with a key?), passive voice intransitive sentences where both nouns may assume agency in the action (Are patients treated by doctors?), and complex aspectual and modal distinctions (If I told you I used to smoke, do I still smoke now?). The QAB does not make use of sentence-picture matching since it involves taxing cognitive resources such as working memory. The yes-no questions require limited non-linguistic functions but beget a limitation in that more items are needed since there are only two possible answers.

(5) Picture naming which looks into anomia. Patients are presented with stimuli cards which show six items and are then asked to name each item in turn, upper row then lower row. The QAB uses the Boston Naming Test (BNT) (Kaplan, Goodglass & Weintraub, 1983) as a reference for this subtest, and based on the item response theory underlying the BNT, the items span a wide difficulty range, from words as easy and ubiquitous as dog and comb for the Lebanese Arabic test, to octopus, compass and the Sphinx.

(6) Repetition which sees the patient repeating six items after the examiner. The first four items are single words with increasing numbers of syllables. The fifth item is a three-word sentence and the sixth item is a six-word sentence of words of different frequencies (one low, two medium, three high).

(7) Reading aloud in which the patient is shown six items and then asked to read them aloud. Four of these items are words and two are sentences.

(8) Motor speech which has the examiner ask the patient to follow commands that involve motor speech such as moving their tongue side to side, holding the vowel [a], and counting to ten. This subtest looks into whether or not the patient demonstrates apraxia of speech and/or dysarthria.

Subtests 2 to 8 inform the calculation of the summary measures which in turn form the QAB overall score. Thus, the eight derived summary measures are: (1) Word comprehension; (2) Sentence comprehension; (3) Word finding; (4) Grammatical

constructions; (5) Speech motor programming; (6) Repetition; (7) Reading and (8) QAB overall. The summary measures are scored on scale from 0 to 10 with 0 signifying no impairment and 10 severe impairment. The summary measures' calculation is detailed in Table 2, with the method of calculation emulating that of Wilson's (2018). . The overall summary measure score of the QAB is used to identify individuals with aphasia, and the other summary measures can help identify the language domains that are most affected.

The Adaptation Process of the QAB

To ready the QAB for use in Lebanon, and for the Lebanese Arabic-speaking people, the instructions of the original English version were first translated into Modern Standard Arabic (MSA) in accordance with the World Health Organization (WHO) guidelines by two separate sworn translators, and then back-translated to English, similarly to other adaptation studies that followed the WHO guidelines (Tietschert, 2016). To address the phenomenon of diglossia in Lebanon, the Lebanese Arabic QAB uses both varieties of Arabic spoken in Lebanon for different purposes. First, MSA was chosen for the instructions because it is the standardized variety of Arabic taught in schools and used for official purposes in Lebanon; however, the test items themselves were prepared and presented to the participants in Lebanese Arabic, the local spoken dialect, since it reflects the natural speech of the Lebanese people. The parts in MSA may also serve as a template that can be used by all Arabic speakers in future adaptations of the assessment tool.

The selection of culturally appropriate items for the Lebanese Arabic QAB was carried out with the help of two Arabic linguists, who made suggestions for changes based on grammatical rules and the syllabic combinations possible in the local variety. A pilot sample of healthy individuals (N = 30) from around Beirut was used to test the preliminary version of the QAB, and adjustments were made to the item list based on their feedback.

For the Word comprehension subtest, in the semantic foil subsection, words such as violin and trombone were replaced with flute and guitar in one form of the test (Form 1), while in another form (Form 2) oud and a goblet drum were used. For the phonological foil subsection, virtually all words were changed to reflect the unique Lebanese Arabic phonological system with words such as debbene 'fruit fly' used to contrast with debbebe 'tank' in Form 1 and safi:ne 'ship' contrasted with siki:ne 'knife' in Form 2. Inter-dialectal variation in the Lebanese Arabic continuum was also considered and all words selected were words that are used similarly across the different topolects and that are pronounced mostly similarly.

For the Sentence comprehension subtest, the sentence content was changed wherever an action was deemed culturally inappropriate replacing 'cutting grass with an axe' to 'cutting a tree with scissors' since mowing lawn in Lebanon is not a widespread action. In terms of sentence types (simple situational, simple with instruments, intransitive, complex aspectual), no changes were made, for

example Arabic expresses intransitivity similar to English by modifying the verb and placing the object at the beginning of the sentence; therefore, adaptation of this category remained faithful to the original version.

Similar to the Word comprehension subtest, the Picture naming subtest saw changes in words that were deemed too unusual or that had no specific Arabic word to describe them e.g. escalator in the English version. These words were replaced with other words that matched the assigned difficulty but which Lebanese Arabic speakers were familiar with such as cacti instead of seahorses.

For the Repetition subtest, items were changed to match syllable count so 'catastrophe' becomes 'samaket l-qorʃ ' (lit. shark). The sentences in the English version also had higher word counts because demonstratives and prepositions in English count as separate words whereas in Arabic they are prefixed and suffixed; for that reason, equal number of words per sentence was not the goal during the adaptation, but rather matching syllable-count and the frequency of the words used.

Likewise, for the Reading aloud subsection, the words were changed to reflect Arabic syllabic structures and consonant clusters; however, two challenges were encountered: Arabic spelling, unlike English, follows typical spell-sound correspondences but does not write down short vowels which are either marked with diacritics or understood from context; this was circumvented by selecting words that may only have one correct spelling and therefore a specific vocalic template that only works for it so نس is read as sin and not son or san. The second challenge is that Lebanese Arabic does not have a standardized writing system so certain phonemic idiosyncrasies are difficult to represent in text. The most common way to write Lebanese Arabic is using the Modern Standard Arabic writing system which means graphically representing sounds that are not necessarily pronounced. Considering all of this and that written Arabic is learned for the sake of reading MSA, the sentences in this subsection were written in MSA with the scoring not taking into account instances where a reader pronounces a word the way they would in Lebanese Arabic.

Statistical Analyses

Krukal-Wallis tests and Spearman correlation tests were employed in order to investigate if age, region of origin, second language proficiency and level of education were related to the Lebanese Arabic QAB subtests' scores. The use of aforementioned nonparametric tests is due to the skewed distribution of the data for both the HC and PWA groups across all variables. The Shapiro-Wilk tests had a p-value < 0.05 in all instances, indicating that the data was always deviating from the normal distribution. Additionally, a multivariate analysis was run to complement the findings of the latter two in order to find which variables contributed the most to the QAB overall summary measure.

As for assessing the reliability of the Lebanese Arabic QAB, Cronbach's alpha was calculated, and the test-retest reliability was assessed by computing intra-class

Table 3. Mean Scores (and Standard Deviations) for HC and PWA Groups across the QAB Summary Measures

QAB Measure	HC	PWA		
		Acute	Chronic	Aphasia Total
Word Comprehension	9.91 (.27)	9.13 (1.89)	9.24 (1.47)	9.19 (1.62)
Sentence Comprehension	9.39 (1.00)	5.42 (3.44)	3.54 (2.96)	4.29 (3.24)
Word Finding	9.53 (.68)	6.25 (3.23)	5.01 (1.94)	5.51 (2.56)
Grammatical Constructions	9.99 (.02)	8.12 (1.98)	6.79 (2.48)	7.32 (2.35)
Speech Motor Programming	10.00 (.00)	9.58 (1.44)	7.92 (3.76)	8.58 (3.13)
Repetition	9.95 (.19)	7.05 (3.32)	5.76 (2.23)	6.28 (2.74)
Reading	9.98 (.13)	7.08 (3.75)	5.56 (2.36)	6.17 (3.03)
QAB overall	9.80 (.28)	7.28 (2.19)	6.17 (1.37)	6.61 (1.80)

Note: HC – Healthy Controls Group; PWA – People With Aphasia group

Figure 1. *Boxplot Showing Distribution of Summary Measures among HC and PWA*

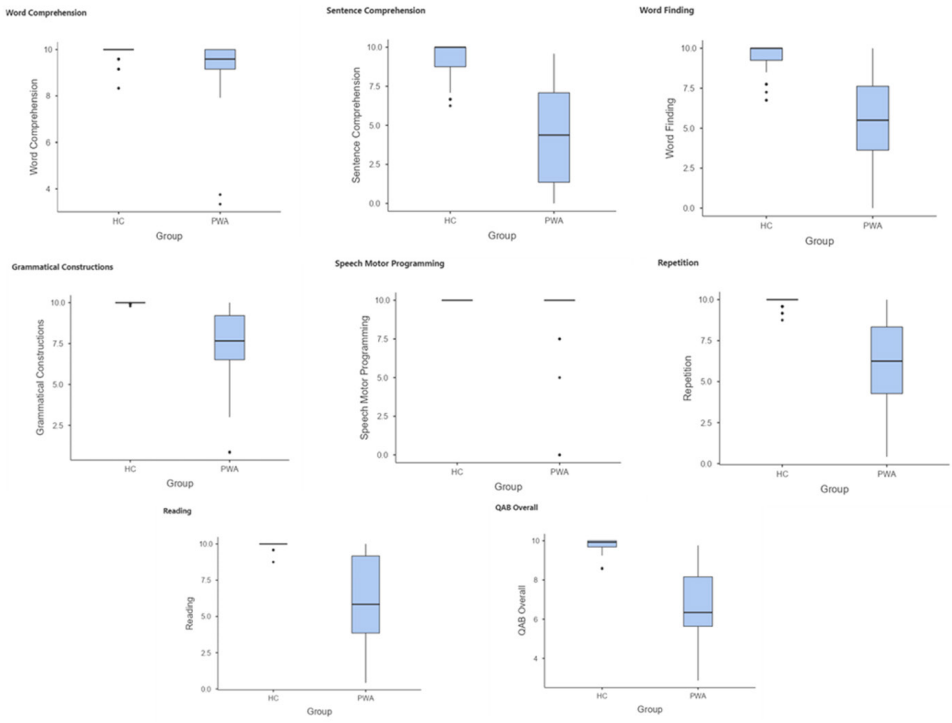


Table 4. Kruskal-Wallis Tests' Results for the Differences in the QAB Summary Measures Depending on the Educational Level in the Healthy Controls Group

	Mean Ranks for the QAB Summary Measures							
Educational Level	**Word Comprehension**	**Sentence Comprehension**	**Word Finding**	**Grammatical Construction**	**Speech Motor Programming**	**Repetition**	**Reading**	**QAB overall**
Basic	58.11	54.91	50.54	55.98	66.50	54.96	66.04	50.15
Intermediate	63.97	58.73	56.36	69.87	66.50	68.84	69.00	56.04
Secondary	69.42	70.39	76.38	64.57	66.50	65.46	63.69	71.97
Higher	71.19	77.16	76.14	71.78	66.50	72.50	67.23	81.08
Chi-Square	6.005	9.309*	13.033**	9.859*	0.000	12.734**	3.347	14.094**

Note: * $p < .05$; ** $p < .01$

Table 5. Spearman's Correlation Coefficient Between Age and the Summary Measures for the Healthy Sample

	Correlation coefficient (Spearman)	
QAB summary measure	**HC group**	**PWA group**
Word Comprehension	-.198*	-.224
Sentence Comprehension	-.274**	-.051
Word Finding	-.183*	-.232
Grammatical Construction	-.138	-.234
Speech Motor Programming	-	-.257
Repetition	-.176*	-.193
Reading	.004	-.204
QAB overall	-.267**	-.326

Note: * $p < .05$; ** $p < .01$

Table 6. Kruskal-Wallis Tests' Results for the Differences in the QAB Summary Measures Depending on the Educational Level in the Healthy Controls Group

	Standardized Coefficient	**t**	**F(3,158)**	**adjusted R2**
Group (HC-PWA)	.80	17.64***	132.67***	.71
Age	-0.7	-1.40		
Education	.06	1.40		

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

coefficients. As for its concurrent validity, the Mann-Whitney U test was used to investigate the difference in performance between the study's two groups, while for the construct validity, a correlation matrix with Spearman's correlation coefficient was utilized to examine the intercorrelations among the summary measures.

Finally, to determine the presence or absence of aphasia among Lebanese Arabic-speakers, a receiver operating characteristic (ROC) was used to determine the cut-off score for the QAB total score summary measure.

Results

Distribution of the QAB Summary Measures and their Relation to the Demographic Variables

The scores across all eight measures for each group are presented in Table 3 while the distribution of the summary measures for the PWA group and the control HC group is displayed in Figure 1. Compared to the PWA group, the HC group exhibited a narrower distribution for all summary measures, and most participants achieved ceiling scores. However, outliers were identified in both groups, including three participants from the HC group who did not achieve ceiling scores in word comprehension, grammatical construction, and repetition. Additionally, the average evaluation duration for all aphasic participants was 15.70 minutes with a standard deviation of 3.87.

Kruskal-Wallis tests were performed on the HC scores to investigate the relation between educational level, region of origin, and second language proficiency and the QAB summary measures. Results revealed that in the healthy sample there were no significant differences in the QAB summary measures depending on the region of origin ($chi^2 = 6.128$, $p = 0.190$ for the QAB overall summary measure) or second language proficiency ($chi^2 = 0.939$, $p = 0.625$ for the QAB overall summary measure). The present study, however, found significant differences in several of the summary measures, depending on the educational level . Results presented in Table 4 demonstrate statistically significant differences in Sentence Comprehension, Word Finding, Grammatical Construction, Repetition, and the QAB overall score.

Overall, a trend was observed whereby higher educational levels corresponded to better performance. A pot-hoc analysis using Tukey's HSD revealed that participants with higher level education outperformed participants with basic education in all above-mentioned summary measures, and participants with secondary education outperformed those with basic education in Word Finding only. Contrastively, when running the Kruskal-Wallis tests for the PWA group, educational level was not found to differentiate scores within any of summary measures. The Spearman correlation coefficient was calculated to investigate the relation between age and the summary measures for the HC and PWA groups these results are reported in Table 5. A negative and statistically significant correlation was observed for all summary measures except for Reading, Grammatical

Construction and Speech Motor Programming, which had a distribution at the ceiling level without any outliers, and therefore could not be calculated. The QAB overall score displayed a coefficient of -.267 and a *p*-value < .001, indicating that older individuals obtained lower scores on this measure.

A U Mann-Whitney test was run to explore age differences between the HC and PWA groups, and the results show that age is indeed significantly different between the two groups with a *p*-value <0.05. Additionally, a Univariate Analysis was run with age as a covariate, the participants' aphasia status (HC or PWA) as the fixed factor, and the QAB overall score summary measure as the dependent variable. The p-value for age was >0.05 which indicates that age does not significantly contribute to the differences between the HC and PWA groups. Despite this, age still affects how participants perform in the summary measures with older individuals in the HC group performing worse than the younger participants in most summary measures.

A multivariate regression analysis was also performed to examine demographic (age, education level) and health (suffering from aphasia) predictors of the QAB overall score.. The analysis showed that in this model, health status (i.e. HC or PWA) had the greatest contribution to the QAB overall score.

Reliability of the Adapted QAB

To assess the temporal stability of the QAB test, 15 chronic aphasic participants were evaluated twice within a two-week interval. The study computed two types of intra-class coefficients (ICC): A-1 and A-k, with the former following a two-way mixed model with absolute agreement, as recommended by Koo and Li's (2016) guideline. The test employed two different forms of the QAB for each session, which necessitated the calculation of A-k to account for the average scores of both forms. The results presented in Table 7 demonstrate that the ICCs-1 (type A-1) were good for Word Comprehension, Sentence Comprehension, and Word Finding (ranging from 0.7 to 0.9), and excellent for the other summary measures (greater than 0.9). Furthermore, the ICC-k (type A-k) exhibited an increase in reliability for all measures, with only Word Comprehension and Grammatical Construction being good, although a few decimals short of being excellent, while the rest achieved an excellent rating.

To assess the reliability Cronbach's alpha, which reflects the degree to which all items within the test are measuring the same construct or concept, and are therefore interrelated, was calculated on data from both HC and PWA groups. The study found that Cronbach's alphas were acceptable, ranging from good to high (Tavakol & Dennick, 2011) for all measures except one (with values between 0.839 and 0.944), as presented in Table 8.

Sensitivity and Specificity of the Adapted QAB

Similar to the original, English version of the QAB, the QAB overall

Table 7. The Intraclass Correlations ICC-1 and ICC-k for the QAB Summary Measures

QAB Summary Measures	ICC-1	ICC-k
Word Comprehension	0.810	0.895
Sentence Comprehension	0.830	0.907
Word Finding	0.790	0.883
Grammatical Construction	0.949	0.974
Speech Motor Programming	0.972	0.986
Repetition	0.920	0.958
Reading	0.915	0.956
QAB overall	0.920	0.958

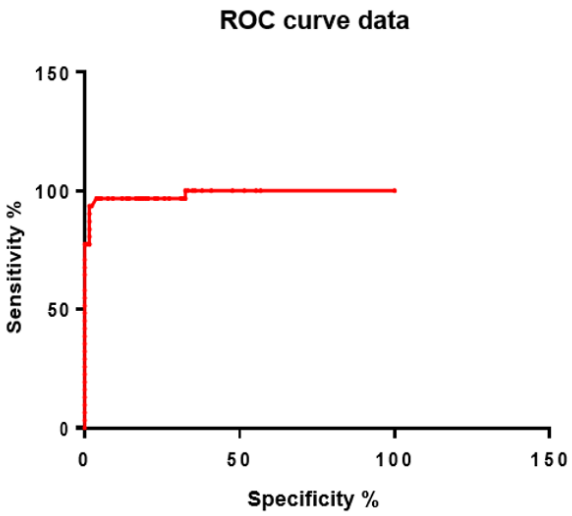
Note: All values are significant at $p < .001$)

Table 8. Internal Consistency of the QAB Summary Measures

QAB Summary Measures	Cronbach's alpha
Word Comprehension	0.861
Sentence Comprehension	0.839
Word Finding	0.938
Grammatical Construction	0.923
Speech Motor Programming	-
Repetition	0.932
Reading	0.944
QAB overall	0.935

Note: All values are significant at $p < .001$)

Figure 2. *Receiver Operating Characteristic (ROC) Plot*



summary measure was selected as the primary indicator of the presence or absence of aphasia. The receiver operating characteristic (ROC) plot (Fig. 2) was used to determine the cut-off score, which was decided to be 9.2 with a high sensitivity (Sn) of 96.7% and specificity (Sp) of 96.2%. This trade-off between Sn and Sp was selected since they were nearly equivalent, which is often recommended when determining the optimal cut-off scores (Habibzadeh et al., 2016).

Validity of the Adapted QAB: Concurrent and Construct Validities

The Mann-Whitney U test was utilized in this study to examine potential differences in performance between the two groups, the HC group and the PWA group. The results, presented in Table 9 indicate a statistically significant differences ($p < .001$) between the two groups across all summary measures.

In order to evaluate the construct validity of the QAB, a correlation matrix (Table 10) was constructed to examine the intercorrelations among the summary measures based on the scores of the PWA group. Spearman's correlation coefficient was utilized to measure the strength of the relationship between the variables. The results demonstrated significant correlations between all summary measures and the QAB overall measure, with a significance level of $p < .01$.

Discussion

The main purpose of the study was to develop a language assessment tool that could be used with the Lebanese Arabic-speaking population, specifically those suffering from language impairment as a result of a brain damage. The Quick Aphasia Battery (QAB) was, therefore, chosen for cultural adaptation due to its relatively short length and comprehensive description of the type of aphasia and its severity. The socio-demographic information collected from the participants showed that region of origin, and knowledge of a second language are not significantly related to the test's summary measures. However, age and level of education were found to be related to several of the measures.

The negative correlation between age and most of summary measures is in line with several previous studies (Burke & Shafto, 2004; Shafto & Tyler, 2014). The decline in psychological performance due to aging has been historically attributed to age, and research has shown that with regards to language, certain processes are more vulnerable to aging, especially word production and retrieval. For example, people name pictures less accurately with age (Ellis & Urban, 2016).

Other studies have also established a relation between an individual's education level and their language performance, whereby a higher level of

Table 9. Mean Ranks of the HC and PWA Groups Across the QAB Summary Measures and Mann-Whitney U *z* Score

QAB summary measure	Mean Rank		*z*
	HC group	PWA group	
Word Comprehension	87.86	53.50	-5.154***
Sentence Comprehension	95.20	21.22	-8.434***
Word Finding	94.57	24.00	-7.752***
Grammatical Construction	95.39	20.40	-10.260***
Speech Motor Programming	85.00	66.10	-5.655***
Repetition	94.22	25.52	-9.752***
Reading	93.85	27.15	-10.377***
QAB overall	96.10	17.27	-8.497***

Note: HC: Healthy controls group; PWA: Participants with aphasia group. *** $p < .001$

Table 10. Correlation Matrix (Spearman Correlations) between the QAB Summary Measures for the PWA Group

QAB summary measures	1	2	3	4	5	6	7
1 QAB overall score	-						
2 Word Comprehension	.566*	-					
3 Sentence Comprehension	.912*	.504*	-				
4 Word Finding	.898*	.471*	.743*	-			
5 Grammatical Construction	.734*	.544*	.712*	.695*	-		
6 Speech Motor Programming	.337*	.135	.308*	.326*	.435*	-	
7 Repetition	.725*	.512*	.708*	.691*	.922*	.418*	-
8.Reading	.702*	.467*	.718*	.676*	.832*	.454*	.836*

Note. * Correlation is significant at the 0.01 level

education is associated with better language proficiency (Al-Thalaya et al., 2018; Tsapkini, Vlahou, & Potagas, 2010). The current study examined various measures of language performance, including sentence comprehension, word finding, grammatical construction, repetition, and the overall summary measure of QAB, and found that they were positively related to the level of education in the healthy controls group. Contrastively, this study found no significant relation between education level and language performance in the PWA group; this, however, may also be the result of small sample sizes in each education level for the PWA group. These findings suggest that age and education level should be taken into consideration when administering the QAB in future assessments of language impairment in the Lebanese Arabic-speaking population.

In addition to norming the data on the healthy population, the performance of the HC and PWA groups was compared. As expected, the HC group performed significantly better than the PWA group, with several measures at or near ceiling level, consistent with the findings of the original study by Wilson et al. (2018). Among the HC group, only the sentence comprehension, word finding, and the QAB overall measures showed variation. The QAB overall measure, in particular, showed variation as a result of both age and education. We also noted that extreme outliers were present in the HC group for each measure, including participants who answered spontaneously and then corrected themselves a second later. To maintain consistency and prevent bias, the scores of self-corrected responses were lowered by one grade, even for the HC group, as per Wilson's (2018) original grading guidelines.

Furthermore, the test's reliability was assessed by looking into both test-retest stability (intra-rater reliability) for the PWA group (specifically, for particpants with chronic aphasia), and the internal consistency of the summary measures. For the test-retest reliability, the intraclass correlation coefficients (ICCs) for all measures showed good to excellent reliability, ranging from 0.81 to 0.95. The Cronbach's alphas were acceptable (alphas > .83) for all measures.

The cut-off score for the QAB overall summary measure was determined to be 9.2 with a sensitivity of 96.7% and specificity of 96.2%. This indicates that 96.7% of participants identified with aphasia were confirmed to have it through clinical impression and/or previous language assessments by speech pathologists. It is important to consider the possibility that some participants may score below the cut-off despite not being identified with aphasia due to distraction or a lower level of education, particularly among older individuals. Overall, the results suggest that the QAB is a reliable tool for identifying aphasia with a high level of accuracy. However, additional factors such as age and education level should be considered when interpreting individual scores.

Concurrent and construct validity of the QAB were also assessed. The concurrent validity explored the test's ability to distinguish between the HC and PWA groups and it was shown that the two groups differed significantly

in their QAB summary measure scores, where the HC outperformed their PWA counterparts in every measure. As for the construct validity, the analysis revealed that all summary measures were correlated with the QAB overall measure, with sentence comprehension and word finding showing the highest correlation (.912 and .898 Spearman's coefficient values, respectively).

This study demonstrated that the QAB is a reliable and valid tool for detecting aphasia among the Lebanese Arabic-speaking population. The battery's instructions were translated into Modern Standard Arabic, which is the formal language of the country and is understood by all Lebanese and Arabic-speaking populations. This translation can benefit other Arabic-speaking countries that may wish to adapt the QAB into their dialects. Speakers of Syrian, Palestinian and Jordanian Arabic may also benefit from the Lebanese QAB since all varieties belong to the Levantine cluster of dialects and share similar phonological, morphological and syntactic systems. The items chosen for the Lebanese Arabic QAB also reflect concepts, things and ideas readily available in the Syrian, Palestinian and Jordanian lexis.

Limitations of the Study

Limitations of this study are inherent in the test itself, including the absence of a writing subtest, the trade-offs made to reduce test administration time such as a reduced number of items, which may compromise the description of the type of aphasia present by each summary measure. Furthermore, test-retest data was obtained only from individuals with chronic aphasia and not from those with acute aphasia. However, according to Wilson et al. (2018), rapid improvement in language among patients with acute aphasia makes it challenging to conduct interviews with them. In addition, inter-rater reliability was not assessed, which may weaken the overall reliability of the test. Additionally, this study did not include therapy history as a variable or measure and, therefore, could not assess its effect on an individual's performance.

Finally, the QAB excludes illiterate individuals, including many elderly individuals who did not have the opportunity to study to write and read. Although adult literacy rates in Lebanon are increasing and were reported as 94.1% in a 2018 study (Knoema, 2018), the remaining six percent, who are primarily elderly and more prone to strokes (Boehme, Esenwa, & Elkind, 2017), cannot be assessed using the QAB unless the reading section is removed.

Conclusion

The Quick Aphasia Battery (QAB) was selected for an adaptation into Lebanese Arabic due to its convenient length and its capacity for a thorough assessment of the type and severity of aphasia. Our study, which included both neurologically intact individuals and people with aphasia, demonstrated that the adapted QAB is a reliable and valid tool for assessing language disturbances. Additionally, we found that age and educational level are factors

that are related to the QAB performance, with a negative association for age and a positive one for education. The validation tests showed that the Lebanese Arabic QAB demonstrates good to excellent internal consistencies and test-retest reliability and a look at concurrent and construct validities showed that the measures are all correlated with the QAB overall measure used to identify and describe aphasia for post-stroke patients.

The development of the Lebanese Arabic version of the QAB is an important step forward for research in aphasia among Arabic-speaking populations. The lack of a standardized assessment tool has historically hindered such research, including studies on agrammatism and the prevalence of aphasia in patients with non-stroke-related conditions or who are taking potentially aphasia-inducing medications. Furthermore, the QAB was standardized using both Modern Standard Arabic and Lebanese varieties to ensure accessibility to all Lebanese-Arabic speakers and facilitate adaptation by researchers in other Arabic dialects.

Overall, the Lebanese Arabic adaptation of the QAB has the potential to advance understanding of aphasia and language disturbances in Arabic-speaking populations, and may serve as a valuable tool for clinicians and researchers in the field, in addition to being a valuable tool for the early detection of aphasia and in guiding a rehabilitation plan for those affected.

Conflict of Interest Disclosure

The Author reports no conflicts of interest.

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Research Ethics Statement

The approving institution for this study is Rafik Hariri University Hospital, according to 21CFR56 and 45CFR46. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and participants were provided with a consent form outlining the purpose of the study, their rights, and data confidentiality. Anonymity was ensured, and no identifying information was disclosed in the reporting of data or results.

Data Availability Statement

Data associated with the current study will be made available upon reasonable request to the corresponding author.

References

Abou El-Ella, M. Y., Alloush, T. K., El-Shobary, A. M., El-Dien Hafez, N. G., Abd EL-Halim, A. I., & El-Rouby, I. M. (2013). Modification and standardisation of Arabic version of the Comprehensive Aphasia Test. *Aphasiology*, *27*(5), 599–614. https://doi.org/10.1080/02687038.2013.793282

Abou-Elsaad, T., Baz, H., Belal, T., & Elsherbeny, S. (2018). Developing an Arabic screening test for adult-onset chronic aphasia. *Folia Phoniatrica et Logopaedica*, 70(2), 74–81. https://doi.org/10.1159/000490105

Abu Kwaik, K., Saad, M., Chatzikyriakidis, S. & Dobnik, S. (2018). A lexical distance study of Arabic dialects. *Procedia Computer Science*. 142. 2-13. 10.1016/j.procs.2018.10.456.Z

Adam, H. (2023). Morphosyntactic aspects of agrammatism in Palestinian Arabic: Findings from a Semitic language. *Revista de Investigación en Logopedia*, 13(2), e85225. https://doi.org/10.5209/rlog.85225

Albustanji, Y. M., Milman, L. H., Fox, R. A., & Bourgeois, M. S. (2013). Agrammatism in Jordanian-Arabic speakers. *Clinical Linguistics & Phonetics*, *27*(2), 94–110. https://doi.org/10.3109/02699206.2012.742568

Altaib, M. K., Falouda, M., & Meteyard, L. (2021). From informal to formal: The preliminary psychometric evaluation of the short aphasia test for Gulf Arabic speakers (SATG). *Aphasiology*, *35*(8), 1048–1066. https://doi.org/10.1080/02687038.2020.1765303

Al-Thalaya, Z., Nilipour, R., Sadat Ghoreyshi, Z., Pourshahbaz, A., Nassar, Z., & Younes, M. (2018). Reliability and validity of bedside version of Arabic Diagnostic Aphasia Battery (A-DAB-1) for Lebanese individuals. *Aphasiology*, 32(3), 323–339. https://doi.org/10.1080/02687038.2017.1338661

Baker, C., Worrall, L., Rose, M., Hudson, K., Ryan, B., & O'Byrne, L. (2018). A systematic review of rehabilitation interventions to prevent and treat depression in post-stroke aphasia. *Disability and Rehabilitation*, *40*(16), 1870–1892. https://doi.org/10.1080/09638288.2017.1315181

Benson D. F. (1986). Aphasia and the lateralization of language. Cortex, 22(1), 71–86. https://doi.org/10.1016/s0010-9452(86)80033-8

Berthier M. L. (2005). Poststroke aphasia : Epidemiology, pathophysiology and treatment. *Drugs & aging, 22*(2), 163–182. https://doi.org/10.2165/00002512-200522020-00006

Boehme, A. K., Esenwa, C., & Elkind, M. S. V. (2017). Stroke risk factors, genetics, and prevention. *Circulation Research*, 120(3), 472–495. https://doi.org/10.1161/CIRCRESAHA.116.308398

Burke, D. M., & Shafto, M. A. (2004). Aging and language production. *Current Directions in Psychological Science*, *13*(1), 21–24. https://doi.org/10.1111/

j.0963-7214.2004.01301006.x

Dalemans, R. J. P., De Witte, L., Wade, D., & Van Den Heuvel, W. (2010). Social participation through the eyes of people with aphasia. *International Journal of Language & Communication Disorders*, *45*(5), 537–550. https://doi.org/10.3109/13682820903223633

Ellis, C., & Urban, S. (2016). Age and aphasia: A review of presence, type, recovery and clinical outcomes. Topics in Stroke Rehabilitation, 23(6), 430–439. https://doi.org/10.1080/10749357.2016.1150412

Ezzeddine, N. (2017). Adaptation du Bilingual Aphasia Test (version courte) au libanais: Données linguistiques et psychométriques [Adaptation of the Bilingual Aphasia Test (short version) into Lebanese: Linguistic and psychometric data] [Master's thesis, Université Toulouse-Jean Jaurès]. https://dumas.ccsd.cnrs.fr/dumas-01858664v1

Flowers, H. L., Skoretz, S. A., Silver, F. L., Rochon, E., Fang, J., Flamand-Roze, C., & Martino, R. (2016). Poststroke aphasia frequency, recovery, and outcomes: A systematic review and meta-analysis. *Archives of Physical Medicine and Rehabilitation, 97*(12), 2188–2201.e8. https://doi.org/10.1016/j.apmr.2016.03.006

Goodglass, H. (1993). *Understanding aphasia*. San Diego: Academic Press.

Habibzadeh, F., Habibzadeh, P., & Yadollahie, M. (2016). On determining the most appropriate test cut-off value: The case of tests with continuous results. Biochemia Medica, 297–307. https://doi.org/10.11613/BM.2016.034

Horesh, U., & Cotter, W. M. (2016). Current research on linguistic variation in the Arabic-speaking World. *Language and Linguistics Compass*, *10*(8), 370–381. https://doi.org/10.1111/lnc3.12202

Imoisili, O. E., Chung, A., Tong, X., Hayes, D. K., & Loustalot, F. (2024). Prevalence of stroke - Behavioral risk factor surveillance system, United States, 2011-2022. *MMWR. Morbidity and Mortality Weekly Report*, *73*(20), 449–455. https://doi.org/10.15585/mmwr.mm7320a1

Ivanova, M. V., & Hallowell, B. (2013). A tutorial on aphasia test development in any language: Key substantive and psychometric considerations. *Aphasiology*, 27(8), 891–920. https://doi.org/10.1080/02687038.2013.805728

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *The Boston Naming Test*. Lea & Fibige. https://doi.org/10.1037/t27208-000

Khwaileh, T., & Grosvald, M. (2019). The use of translated materials in assessing aphasia patients in Qatar: Problems and Solutions. *Arab Journal of Language and Linguistics, 4(1)*, 38–49. https://www.arjals.com/ajal/article/view/176

Knoema (2018). *Lebanon - Adult (15+) literacy rate*. https://knoema.com/atlas/Lebanon/topics/Education/Literacy/Adult-literacy-rate

Koo, T. K., & Li, M. Y. (2016). A Guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

Lahoud, N., Salameh, P., Saleh, N., & Hosseini, H. (2016). Prevalence of Leb-

anese stroke survivors: A comparative pilot study. Journal of epidemiology and global health, 6(3), 169–176. https://doi.org/10.1016/j.jegh.2015.10.001

Rami, Y., Diouny, S., Kissani, N., & Boudanga, A. (2021). *Validation of the Moroccan Arabic version of the token test*. In Proceedings of the 12th International Conference of Experimental Linguistics. Athens, Greece. https://doi.org/10.36505/ExLing-2021/12/0048/000521.

Roby-Brami, A., Hermsdörfer, J., Roy, A. C., & Jacobs, S. (2012). A neuropsychological perspective on the link between language and praxis in modern humans. Philosophical transactions of the Royal Society of London. Series B, Biological sciences, *367*(1585), 144–160. https://doi.org/10.1098/rstb.2011.0122

Shafto, M. A., & Tyler, L. K. (2014). Language in the aging brain: The network dynamics of cognitive decline and preservation. *Science*, *346*(6209), 583–587. https://doi.org/10.1126/science.1254404

Spaccavento, S., Craca, A., Del Prete, M., Falcone, R., Colucci, A., Di Palma, A., & Loverre, A. (2013). Quality of life measurement and outcome in aphasia. *Neuropsychiatric Disease and Treatment*, 27. https://doi.org/10.2147/NDT.S52357

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Tietschert, M. V., Angeli, F., van Raak, A. J. A., Singer, S. J., & Ruwaard, D. (2016). Translating the patient perception of integrated care survey to measure integrated care in the netherlands: combining equivalence and contextualization approaches for optimal results. *International Journal of Integrated Care*, *16*(3), 11. https://doi.org/10.5334/ijic.2022

Tsapkini, K., Vlahou, C. H., & Potagas, C. (2010). Adaptation and validation of standardized aphasia tests in different languages: Lessons from the Boston diagnostic aphasia examination–short form in Greek. *Behavioural Neurology*, *22*(3–4), 111–119. https://doi.org/10.1155/2010/423841

Wafa, H. A., Wolfe, C. D. A., Emmett, E., Roth, G. A., Johnson, C. O., & Wang, Y. (2020). Burden of stroke in Europe: Thirty-Year projections of incidence, prevalence, deaths, and disability-adjusted life years. *Stroke*, *51*(8), 2418–2427. https://doi.org/10.1161/STROKEAHA.120.029606

Wilson, S. M., Eriksson, D. K., Schneck, S. M., & Lucanie, J. M. (2018). A Quick Aphasia Battery for efficient, reliable, and multidimensional assessment of language function. *PloS One*, *13*(2), e0192773–e0192773. https://doi.org/10.1371/journal.pone.0192773

World Health Organization. (2019, August 5). *Process of translation and adaptation of instruments*. https://www.who.int/substance_abuse/research_tools/translation/en/