Validity and Reliability of the Arabic Patient Health Questionnaire-9 in Patients with Spinal Cord Injury in Lebanon

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■ BACKGROUND: **Depression is a prevalent and disabling condition associated with spinal cord injury (SCI). Such associated negative factor warrants the use of valid and reliable psychological assessment tools among this group. One of the available assessment means is the Patient Health Questionnaire-9 (PHQ-9), a short screening measure that evaluates depression status. Our aim is to test the psychometric properties of the Arabic version of the PHQ-9 including validity and reliability among Lebanese individuals with SCI.**

■ METHODS: **This is a cross-sectional study conducted between January and June 2018, including 51 participants with SCI. Questionnaire and assessment measures were administered to the subjects. The internal consistency, test-retest reliability, and the factor structure of the PHQ-9 were evaluated in addition to the convergent validity, which was established by comparing the scale's total score with the scores of the Hamilton Depression Rating Scale.**

■ RESULTS: **Exploratory factor analysis revealed 3 factors accounting for 66.2% of the total variance. The scale demonstrated good internal consistency (Cronbach's alpha = 0.71) and test-retest reliability (Intraclass correlation coefficient = 0.88). Significant correlation was found between the PHQ-9 and the Hamilton Depression Rating Scale (r = 0.71) suggesting good convergent validity.**

■ CONCLUSIONS: **Our findings suggest that the PHQ-9 has good psychometric properties and is a valid and reliable measure of depression among the Lebanese individuals with SCI.**

INTRODUCTION

Spinal cord injury (SCI) is considered a devastating and traumatic event associated with an overwhelming burden on patient health.[1,2] Those patients encounter detrimental changes and difficulties in everyday life including functional limitation, dependency on caregivers, associated secondary medical conditions, and financial problems.[3,4] In addition to physiological injuries, psychological disorders may occur after SCI. Multiple studies revealed a drop in mental health scale among SCI subjects,[5,6] and thus, affecting their psychological status,[7] triggering a state of depression[6] and affecting quality of life (QoL).[8]

Depression among SCI population can reach between 26% and 30%.[9] It is considered a contributory risk factor for a dismal QoL, worsening chronic pain, extended hospitalization, interpersonal relationships deterioration, and drug addiction predisposition.[10] Therefore, early detection of depression among the SCI population can help provide a treatment plan to improve their QoL and reduce associated comorbidities.

Measures for depression are widely spread and available, however, among the Arabic countries, few studies were designed to determine the validity and use of such scales in assessing the severity of depression. The Patient Health Questionnaire-9

Key words
- Depression
- Lebanon
- Patient health Questionnaire-9
- Psychometrics
- Spinal cord injury

Abbreviations and Acronyms
DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, fourth edition
HDRS: Hamilton Depression Rating Scale
HDRS-A: HDRS, Arabic version
ICC: Intraclass correlation coefficient
KMO: Kaiser—Meyer—Olkin
PHQ-9: Patient Health Questionnaire-9
PHQ-9-A: PHQ-9, Arabic version
QOL: Quality of life
ROC: Receiver operating characteristic
SCI: Spinal cord injury

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(PHQ-9), developed in 2001 by Kroenke et al.,[11] is a brief self-report measure of 9 items, employed to assess and grade depression severity. It showed high internal consistency with Cronbach's alpha between 0.86 and 0.88.[11] In 2004, Bombardier et al.[12] tested the PHQ-9 among the SCI population to assess its psychometric properties. They concluded that PHQ-9 has a sensitivity of 73%, a specificity of 98%, and an internal consistency of 0.87 (Cronbach's alpha).[12] In 2016, Sawaya et al.[13] translated and tested the psychometric properties of the PHQ-9 in Arabic speaking Lebanese psychiatric patients.

To the best of our knowledge, no reliable and suitable screening measure of depression severity among Lebanese subjects with SCI was ever validated. Therefore, our aim is to test the psychometric properties of the Arabic version of the PHQ-9, including validity and reliability among Lebanese individuals with SCI.

METHODS AND MATERIALS

Study Population and Data Collection

A cross-sectional study was conducted over the period extending from January 2018 through June 2018. Participants were recruited from 3 Lebanese rehabilitation centers. Out of 100 Lebanese SCI subjects approached to participate in our study, 51 male patients agreed to enroll. All participants were adults aged between 20 and 60 years and were suffering from traumatic or non-traumatic SCI. Face-to-face interviews took place by 2 specialists in a standardized manner. Each patient completed 2 questionnaires, including the sociodemographic information and the Arabic versions of the PHQ-9 and the Hamilton Depression Rating Scale (HDRS). However, participants who had writing incapacities associated with their disabilities were helped by a nurse. All of them signed a written consent form to participate in our assessment. The study was also approved by the Internal Review Board at the Neuroscience Research Center of the Lebanese University. As for the test-retest reliability of the PHQ-9, Arabic version (PHQ-9-A), 20 participants were re-assessed after an average of 15 days from the initial testing.

Procedure and Measurements

Arabic language was used in the questionnaire during initial interview. It covered 3 main categories in addition to the measurement scales. The general personal information included the participant's age, sex, marital status, address, and education as well as the socioeconomic status comprising the employment state and monthly income. In addition to the medical history, detailed information were gathered concerning date of injury, cause of injury or pathology, site of injury, physical consequence, and motor level.

PHQ-9, Arabic Version

PHQ-9 is a 9-item self-report scale used to assess and grade the severity of depression.[11] The scale used here was the Arabic translated version. The PHQ-9 exclusively covers the 9 diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV), in which clinical diagnosis of depressive disorder is based.[11] Within this Questionnaire, individuals respond to questions regarding experiences bothering them in the last 2 weeks such as: anhedonia, feeling sad or depressed, trouble falling asleep or sleeping too much, feeling tired or having little energy, eating problems, feelings of worthlessness or guilt, concentration problems, psychomotor retardation or agitation, and suicidal thoughts.

The response to each item can be graded on a Likert scale from 0 "absence of symptom" to 3 "presence of symptom nearly every day."[11] The scoring of PHQ-9 is obtained by the sum of the scores of the 9 items ranging from 0–27, with 5, 10, 15, and 20 representing mild, moderate, moderately severe, and severe depression, respectively.[11]

A copy of the instrument, validated among the Lebanese population, and permission were obtained from the author.[13] The cutoff between healthy and depressed individuals is 10.[13] Thus, higher scores indicate greater risk of depression.

HDRS, Arabic Version

The HDRS is the most commonly used scale for the evaluation of patient treatments for depression.[14] The HDRS was originally published in 1960,[15] and since then it has been the gold standard for the assessment of depression.[16]

The HDRS comprises 21 items; the first 17 items target the severity of depression, whereas the last 4 items assess diurnal variation, depersonalization/derealization, paranoid symptoms, and obsessive-compulsive symptoms.[15] The last 4 items are not counted toward the scoring of HDRS because they do not reflect depression severity, but only provide additional clinical information[15]; therefore, total scoring is based on the scores of the first 17 items. Out of the 17 items, 8 items are scored on a 5-point Likert scale, ranging from 0 "not present" to 4 "severe," and 9 items are scored on a 3-point Likert scale from 0–2.[15] The total score is simply calculated by the summation of the first 17 items, and it ranges from 0 to a maximum of 52 points.

Within this study, the scale used was the Arabic translated and adapted version among the Lebanese population. A copy of the instrument and permission were obtained from the author.[17] The cutoff between healthy individuals and depressed patients is 7.5.[17] Thus, a score between 0 and 7.5 is considered normal and a score of 8 or more is considered depressed.

Pilot Study

The questionnaire was pilot tested in a sample of 15 individuals with SCI. The aim was to check the clarity, coherence, and intelligibility of the questions with the average time needed for the participants to accomplish it. Following questionnaire completion, face-to-face interviews were conducted to determine if they experienced any problems or ambiguity. Participants did not report any problems in understanding, and they took an average of 4–6 minutes for completing the questionnaire.

Sample Size Calculation

According to Maccallum and Widaman,[18] to demonstrate a scale's validity and reliability, 5–10 participants for each scale item is recommended. Thus, because the PHQ-9-A scale involves 9 items, the number of participants required is 45–90 participants. In the present study, our sample size is 51 participants.

Statistical Analysis

Data analysis were conducted using IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, New York, USA). To calculate means

Table 1. Sociodemographic Characteristics of the Participants

	Frequency	Percentage (%)
Sex		
Male	51	100
Geographic region		
Beirut	20	39.2
Mount Lebanon	17	33.3
South	8	15.7
North	1	2.0
Bekaa	5	9.8
Marital status		
Single	19	37.3
Married	27	52.9
Divorced	4	7.8
Widowed	1	2.0
Educational level		
Elementary	3	5.9
Middle school	18	35.3
High school	8	15.7
Vocational	9	17.6
University	13	25.5
Employment status		
Unemployed	25	49.0
Free work	5	9.8
Part-time work	5	9.8
Full-time work	16	31.4
Socioeconomic level ($)/month		
No income	1	2.0
500–750	30	58.8
750–1000	13	25.5
1000–1250	4	7.8
1250–1500	0	0
1500–1750	2	3.9
>1750	1	2.0
Cause of the injury		
War and explosions	27	52.9
Motor vehicle accident	7	13.7
Falling	7	13.7
Disease	7	13.7
Others	3	5.9
Physical disability		
Paraplegia	37	72.5
Tetraplegia	14	27.5
	Mean ± SD*	
Age	37.2 ± 12.6	
PHQ-9	7.2 ± 5.2	
HDRS	10.82 ± 7.3	

HDRS, Hamilton Depression Rating Scale; PHQ-9, Patient Health Questionnaire-9.
*Standard deviation.

and standard deviations, descriptive statistics were used. The internal consistency of the scale was measured using Cronbach's alpha, with coefficients above 0.7 reflecting good internal consistency.[19] Exploratory factor analysis, including principle components and scree plot, were used with varimax rotation to analyze factor structure and dimensionality. Factors were selected according to the eigenvalue and visual inspection of the scree plot, with factor loadings and communalities ≥0.5 considered representative within the scale.[20] To ensure sampling adequacy and to assess the appropriateness of carrying out factor analysis, Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity were launched. The KMO index with a score of 0.5 was considered suitable for factor analysis.[21] For convergent validity, the non-parametric Spearman correlation was calculated between the PHQ-9-A and HDRS, Arabic version (HDRS-A), total scores. Test-retest reliability was assessed via the intraclass correlation coefficient (ICC, average measure) for the total scale with ICC >0.75 representing reproducibility.[22] The receiver operating characteristic (ROC) analysis was performed to determine the best cutoff for the PHQ-9-A total score. Patients were divided into 2 groups, depressed and non-depressed, according to the cutoff of 7.5 for HDRS-A. The sensitivity and specificity of the best cutoff and the area under the ROC curve with 95% confidence interval were also calculated.

RESULTS

Sample Characteristics

Table 1 represents the sociodemographic and socioeconomic characteristics of the targeted sample. The sample included 51 men with SCI with an average age of 37.2 ± 12.6 years, a mean PHQ-9-A total score of 7.2 ± 5.2, and a mean HDRS-A total score of 10.82 ± 7.3. Most of the participants were from Beirut (39.2%) and Mount Lebanon (33.3%), whereas others were distributed across the remaining districts (South [15.7%], Bekaa [9.8%], and North [2%]). Half of the participants were married (52.9%), whereas 37.3% were single, and 7.8% were divorced. Concerning the educational level, 25.5% had a high educational

Table 2. Kaiser–Meyer–Olkin Test and Bartlett's Test of Sphericity

Kaiser–Meyer–Olkin Measure of Sampling Adequacy	0.611
Bartlett's Test of Sphericity	
Degrees of freedom	36
Significance	<0.001*

*P value <0.05 is significant.

level, 41.2% had a low educational level, and 33.3% reached high school and vocational sectors.

Concerning the socioeconomic status of the participants, a significant majority (58.8%) had a monthly income ranging from $500–$750, and 25.5% of them had an income of $750–$1000. The remaining minority (13.7%) had an income of >$1000 per month. Approximately half of the subjects were unemployed (49%), whereas 31.4% had a full-time job, 9.8% had a part-time job, and 9.8% were freelancers.

As for the cause of the injury, it was war-induced in half of the participants (52.9%), whereas the other etiologies (disease, motor vehicle accidents, and falling) had equal percentages of occurrence (13.7%) with 5.9% reporting other causes. Moreover, participants with paraplegia comprised 72.5% of the sample compared with 27.5% suffering from tetraplegia.

Factor Analysis

Factor analysis was run over the sample of 51 participants and included the 9-items of the PHQ-9-A. The KMO test (0.61) showed fair sampling adequacy and suitability for factor analysis with a significant Bartlett's test of sphericity (P value < 0.001) (Table 2). Analysis, including scree plot, supported a 3-factor model (Figure 1) with eigenvalue of the first factor = 3.15, the second = 1.57, and the third = 1.22. The 3-factor solution explained 66.2% of the total variance. Furthermore, factor 1 included items 6, 8, and 9 (feelings of worthlessness, physical agitation or retardation, and suicidal thoughts) and explained 27.06% of the variance. Factor 2 included items 1, 2, 3, and 4 (little interest in doing things, feeling down or depressed, sleeping problems, and feeling tired with little energy) and accounted for 21.05% of the variance, whereas factor 3 comprised items 5 and 7 (appetite problems and trouble concentrating) reflecting 18.03% of the variance.

Table 3 represents the factor loading for each item with corresponding communalities. Factor loadings were adequately high for 7 items ranging from 0.71–0.85, and moderate for 2 items (0.53–0.69). Communalities ranged from fair to high (0.50–0.79). Such findings indicate that the 9-items of the

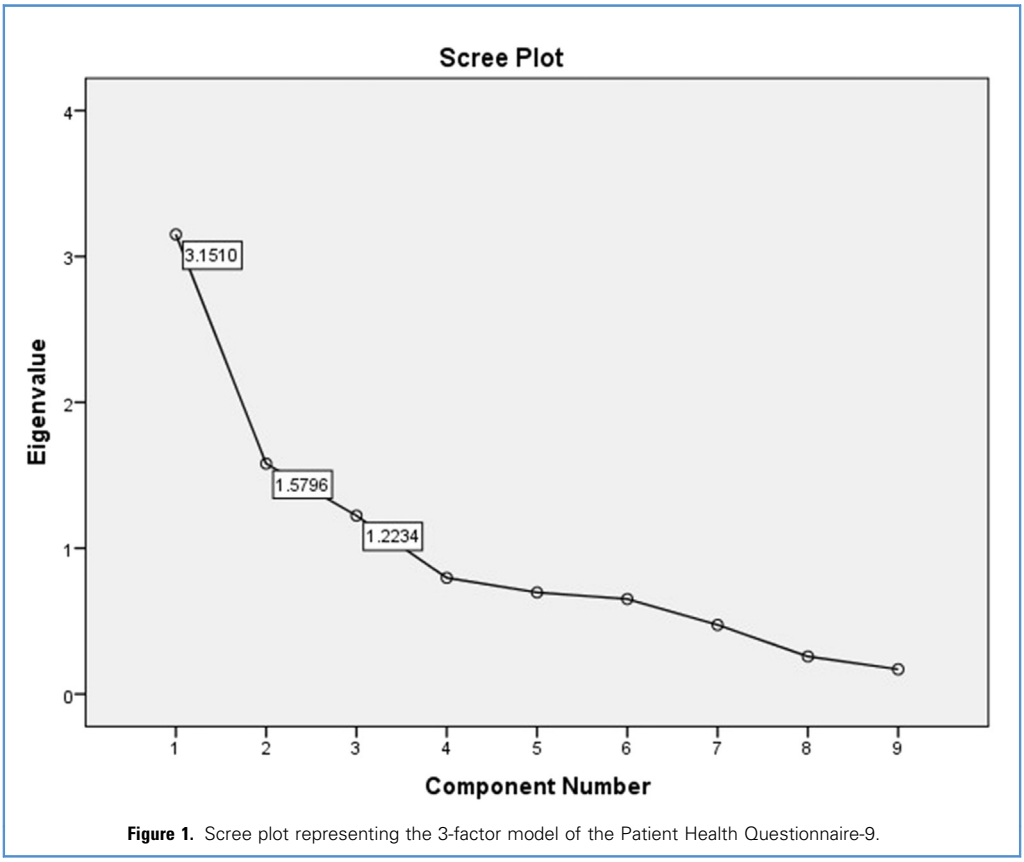

Figure 1. Scree plot representing the 3-factor model of the Patient Health Questionnaire-9.

Table 3. Exploratory Factor Analysis of the Patient Health Questionnaire-9 Scale

Items	Factor 1	Factor 2	Factor 3	Communalities
Feeling bad about yourself, or that you are a failure or have let yourself or your family down.	0.841			0.795
Moving or speaking so slowly that other people could have noticed, or the opposite, being so fidgety or restless that you have been moving around a lot more than usual.	0.823			0.702
Thoughts that you would be better off dead or of hurting yourself in some way.	0.827			0.708
Little interest or pleasure in doing things.		0.713		0.696
Feeling down, depressed, or hopeless.		0.532		0.595
Trouble falling or staying asleep or sleeping too much.		0.690		0.503
Feeling tired or having little energy.		0.713		0.556
Poor appetite or overeating.			0.854	0.738
Trouble concentrating on things, such as reading the newspaper or watching television.			0.803	0.661
Percentage of explained variance	27.06%	21.05%	18.03%	

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization.

PHQ-9-A are representable within the scale and no item should be extracted.[20]

Internal Consistency

The internal consistency of the PHQ-9-A scale was evaluated using Cronbach's alpha. Such reliability analysis showed that the items of the PHQ-9-A had a good internal consistency with an alpha coefficient of 0.71 (Table 4).

Test-Retest Reliability

Test-retest reliability was assessed using ICC with 95% confidence interval (Table 5). The results showed that ICC = 0.88 (0.71–0.95), P value <0.001, which reflects a strong reproducibility of the PHQ-9-A total scale.

Convergent Validity

As for assessing the convergent validity between the PHQ-9-A total scale and the HDRS-A scale, the non-parametric Spearman correlation was calculated. Statistically significant correlation was demonstrated with r = 0.713 and a P value <0.001 (Table 6).

Discriminatory Validity of the PHQ-9- A

The discriminatory validity indicated that the PHQ-9-A has good discrimination validity. It showed a statistical difference between depressed SCI persons and non-depressed SCI subjects (11.8 ± 5.2 vs. 5.8 ± 4.5; P value < 0.001).

Table 4. Internal Consistency-Reliability of the Patient Health Questionnaire-9 Scale

Factor	Cronbach's Alpha	Number of Items
PHQ-9 total scale	0.711	9

PHQ-9, Patient Health Questionnaire-9.

Scale Property and Threshold

ROC curve for the PHQ-9-A screening scale is shown in Figure 2, compared to the HDRS-A diagnoses. The area under the curve was 0.83 (0.72–0.94; P value < 0.001), indicating that the PHQ-9-A has greater discriminatory power. According to the ROC curve, the threshold that gave best sensitivity 83% and specificity 69% was 7.

DISCUSSION

The physical consequences of SCI, as well as the associated health problems, chronic pain,[23] and socioeconomic disadvantages,[8] increase the vulnerability of such population to experience depression that can be considered as a dismal prognostic factor for their QoL.[24] Therefore, it is important to consider and evaluate depression following every patient with SCI, and the use of valid and reliable screening tools is crucial to promote treatment, and thus, improve clinical outcomes.

To the best of our knowledge, this is the first cross-sectional study conducted to validate a depression screening measure among individuals with SCI in Lebanon. Studies targeting this population are null in our country and extremely scarce in the Arab area. In the present study, our aim was to validate the Arabic version of PHQ-9, which is an international psychological scale,

Table 5. Test-Retest Reliability of the Patient Health Questionnaire-9 (n = 20)

Item	Intraclass Correlation (95% Confidence Interval)	*P* Value
PHQ-9 total scale	0.886 (0.711–0.955)	<0.001*

PHQ-9, Patient Health Questionnaire-9.
**P* value <0.05 is significant.

Table 6. Convergent Validity of the Patient Health Questionnaire-9 Scale

Scores Correlation	HDRS Total Scale	*P* Value
PHQ-9 total scale	r* = 0.713	<0.001†

HDRS, Hamilton Depression Rating Scale; PHQ-9, Patient Health Questionnaire-9.
*Non-parametric Spearman correlation r.
†*P* value <0.05 is significant.

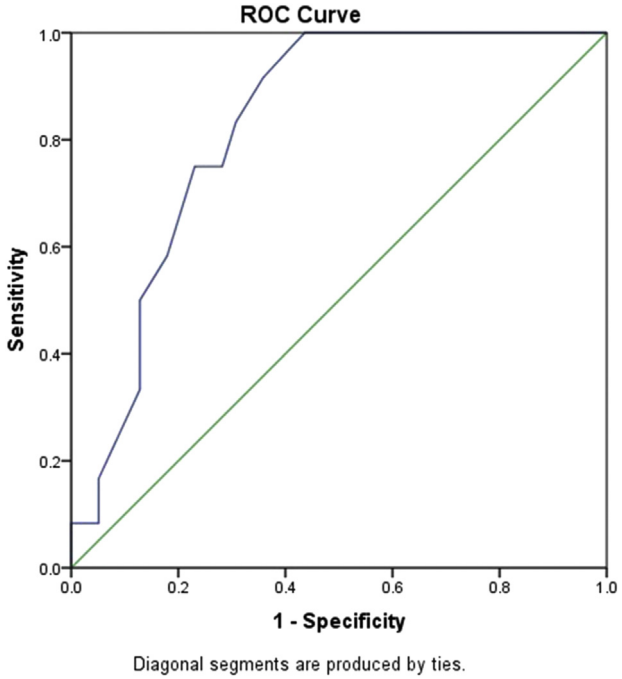

Figure 2. Receiver operating characteristic curve of the Patient Health Questionnaire-9, Arabic version, scale. Area under the curve = 0.83 (0.72–0.94), *P* value <0.001; at value = 7, sensitivity = 83%, and specificity = 69%. ROC, receiver operating characteristic.

for it to be used among the Lebanese SCI population. Our results provide initial evidence supporting the reliability and validity of the PHQ-9-A scale as a screening measure for depression among Lebanese SCI subjects. The exploratory factor analysis extracted 3 factors that reflected good psychometric properties and explained 66.2% of the total variance. Such results replicate what Sawaya et al.[13] demonstrated in their study targeting the validation of PHQ-9 among Lebanese psychiatric patients. However, within the confirmatory factor analysis of their study, they decided that the 2-factor model is more favorable and leads to more interpretable results. Furthermore, this study provides evidence for the convergent validity of the PHQ-9-A total scale showing significant association with another instrument measuring depression, the HDRS-A, which is a validated psychiatric measure of depression in Lebanon and is considered a gold standard for assessing depression.[17] In addition, the internal consistency verified by Cronbach's alpha was determined to be good ($\alpha = 0.71$). Bombardier et al.[12] reported an internal consistency of 0.87 within a study conducted on 849 participants with SCI. Furthermore, the PHQ-9-A showed strong reproducibility among the SCI population within the phase of re-testing, and it provided some evidence of the clinical validity through its ability to discriminate between depressed and non-depressed SCI persons. Taken together, such results provide strong evidence in support of the fact that PHQ-9-A is a valid scale of depression among Lebanese adults with SCI.

It is important to mention the limitations of the present study. The first limitation is the sample size, which might be considered small (n = 51). However, according to the validation guidelines, 5–10 participants for each scale item is recommended to demonstrate a scale's validity and reliability.[18] Because the PHQ-9-A scale includes 9 items, the number of participants required is 45–90 participants, and thus, with a sample size of 51, we can still be considered on the safe side. Moreover, when compared with other studies targeting SCI population in the Middle East region, such as Iran and Turkey, which are considered to be 2 hugely populated countries with big capabilities and presence of multiple specialized centers, we do have similar sample sizes.[25-28] Another limiting factor is the limited number of epidemiological studies and records of population-based data on SCI among the Lebanese population, and thus, measures of prevalence and incidence of SCI are missing. Another drawback is the fact that hospitals and medical centers do not preserve rigorous medical records for patients with SCI during primary hospitalization and rehabilitation phases. Altogether, such problems affected randomization in the selection of the participants and constituted an obstacle in the way of recruiting the targeted number of participants and lengthened the period of data collection.

Another limitation is that all our participants were men. Our country, Lebanon, is located in a geographical area of conflict.[29,30] This fact reflected our results indicating that 52.9% of the participants had war and explosion injuries. In addition, women are usually involved in household activities and in relatively non-dangerous jobs leading to lower risks of SCIs and traumas.[31] However, research is needed to replicate and generalize our results among women.

CONCLUSIONS

The Arabic version of the PHQ-9 demonstrated good psychometric properties in a sample of Lebanese adults with SCI. Internal consistency, test-retest reliability, and convergent validity displayed significant results. Therefore, it can be a useful screening tool for assessing severity of depression among Lebanese men with SCI in medical and community settings.

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