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Screening for Antenatal Depression: A Validation Study from a High-Income Arab Country

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Abstract

Objectives: This study aimed to validate and determine the psychometric properties of the Beck Depression Inventory-II (BDI-II) and Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Design: A cross-sectional study design was employed.

Setting: The antenatal care (ANC) clinics at primary health care centers.

Participants: Women (n=128), in different trimesters of pregnancy, attending the ANC clinics as well as capable of reading and writing in the Arabic language.

Results: A total of 128 participants were interviewed. Upon conducting the receiver operating characteristic (ROC) analysis, the EPDS showed a larger area under the curve at 0.951 than the BDI-II tool (0.912). Using Youden's index, a score ≥13 on the EPDS (87% sensitivity, 82% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) allowed for the greatest division between depressed and non-depressed participants.

Conclusion: To address the under-recognition of antenatal depression, physicians at primary health care centers in Qatar should be encouraged to utilize the EPDS or BDI-II to screen pregnant women seeking antenatal care services.

Strengths and limitations of this study

- This was the first study in the State of Qatar to identify the most suitable screening tool for AD.
- The sample in the current study was derived from a heterogeneous population of pregnant women across the country.
- The examined screening tools in the study were compared with the golden standard (MINI) tool.
- One of the limitations in this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-5) as a tool for diagnosing antenatal depression.

Keywords: mental health; antenatal depression; validation studies; Edinburgh Postnatal Depression Scale; Beck Depression Inventory-II; Mini International Neuropsychiatric Interview

INTRODUCTION

Globally, maternal mental health problems are considered as a major public health challenge with depression affecting 10% of pregnant women.[1, 2] The figures are even higher in the Arab Gulf countries, where antenatal depression (AD) was estimated to impact more than half (57.5%) of expecting mothers in Saudi Arabia and almost a quarter (24%) in Oman during 2016.[3, 4] However, pregnant women with mental disorders can be managed through effective and low-cost interventions after being properly screened by their health care providers.[5, 6]

The United States Preventive Services Task Force (USPSTF) encourages the identification of AD through screening all gravid women at the primary health care level, given the fact that AD is a serious, prevalent, and treatable disease (B recommendation). Nevertheless, there is a lack of strong evidence on the best screening tool to be employed; where the relevant cut-off points have varied from one population to another. [7, 8]

In 2017, a systematic review compared seven AD screening tools including the Edinburgh Postnatal Depression Scale (EPDS), Beck Depression Index (BDI-II), Centre for Epidemiologic Studies Depression Scale (CES-D), Hamilton Rating Scale for Depression (HRSD), Hopkins Symptoms Checklist (HSCL), Kessler Psychological Distress Scale (K10), and Self-Reporting Questionnaire (SRQ). The review concluded that the EPDS was the most suitable AD screening tool in low-resource settings due to its superior level of accuracy and sensitivity. [9]

Several researchers argue that the inclusion of constitutional symptoms (e.g. changes in sleeping pattern and food habits) in the screening of AD is unmerited because they are uninformative and non-specific (common in normal pregnancy). Thus, their use may overestimate the actual burden of the disease. On the other hand, some scholars indicate that somatic symptoms are valid indicators of depression during pregnancy.[10, 11] Similarly, the decision to include or exclude the aforementioned symptoms is crucial for decision-makers as

it will affect their choice of the most effective screening tool. Thus, some experts advocate the use of the EPDS which does not encompass any questions about somatic complains, while others prefer the BDI-II that includes such symptoms.[12, 13]

Given the ease of administrating self-report measures in the clinical and research settings, the identification of an optimal cut-off point could be a key consideration when screening pregnant women. Furthermore, the adequate determination of this threshold in the screening process is necessary to decrease the false positive and false negative rates. The literature reveals that different cut-off points were used among different populations to distinguish between depressed and non-depressed pregnant women. For example, a cut-off value of ≥10 was employed in Korea, ≥11 was utilized in Nigeria, and ≥13 was used elsewhere.[14-17] This indicates that there is no international agreement on a specific cut-off value for AD.

In the State of Qatar, the population is heterogeneous and multilingual but the official language is Arabic. In addition to that, there is lack of evidence regarding the most accurate tool for AD screening among pregnant women in the country. Thus, the objective of this study was to compare the performance of the two screening tools, the EPDS and BDI-II, among pregnant women while benchmarking them with the semi-structured Mini-International Neuropsychiatric Interview (MINI) tool.

METHODS

Study design and setting

This was a cross-sectional study conducted among pregnant women attending the antenatal clinics of the Primary Health Care Corporation (PHCC) in Qatar between August and September of 2018. The primary health centers are the first line of contact between pregnant women and the healthcare system in the country. A random sampling technique was employed through random number generation to select nine health centres from the existing

twenty-three health centers at the time of the study. In each selected health center, all eligible clients attending the antenatal clinic were invited to participate.

Participants

In order to validate the screening tools in question and identify the best performing one, the sample size for the current validation study was based on previously published literature.[18, 19] To be included in the study, the participants had to be pregnant women, capable of reading and writing in the Arabic language, and granting a written consent. There was no restriction to specific trimesters.

Research protocol

The pregnant women who met the inclusion criteria were first informed about the study and its objectives. If consent was given, the participants would receive guiding instructions from trained data collectors and asked to complete the Arabic version of the EPDS and BDI-II before conducting their antenatal care consult. After which, the participants would undergo the Mini-International Neuropsychiatric Interview (MINI) by their primary care physician during their scheduled antenatal care visit. The aforementioned physicians were blinded to the results of the self-administrated tools collected earlier. The assessment of the respondents through the three tools occurred during the same visit. Patients who were diagnosed positive for AD through MINI tool were referred to specialised secondary care for further evaluation and management.

Data collection tools

- The Edinburgh Postnatal Depression Scale (EPDS) is a self-administrated tool and was first published in the British Journal of Psychiatry during 1987. It consists of 10 items and has been validated for use in different populations. [20]

- The Beck Depression Inventory (BDI-II), first introduced in 1961, is a brief 10-minutes self-administered questionnaire that can detect the presence of depressive symptoms. It consists of 21 questions pertaining to the various aspects of mood such as sadness, suicidal ideation, loss of weight, and social withdrawal.[21]
- The Mini-International Neuropsychiatric Interview (MINI) is a short, diagnostic, and structured interview that is used for diagnosing major Axis I psychiatric disorders in DSM-V and ICD-10. [(22)] The MINI tool was employed and validated through several studies, particularly for diagnosing depression disorders.[23-24]

Translation process

Two bilingual English-Arabic clinicians separately translated the EPDS and BDI-II into Arabic. Then, the two translated versions were reviewed and a final draft was made. After which, the draft was back-translated into English by each of the two clinicians. Then, the yielded versions were compared and a few minor revisions were proposed. Subsequently, the Arabic version was piloted on a sample of twenty pregnant women to check to ascertain that it was clear and understandable to participants. The data from the pilot sample was excluded from the analysis of the validation study.

Statistical analysis

The receiver operating characteristic (ROC) analysis was employed to measure the accuracy of the EPDS and BDI-II in diagnosing major depression according to DSM-V criteria. Youden's index was used to determinate the best cut-off points for antenatal depression screening. Cronbach's alpha (α) was used as an estimate of scale reliability, internal consistency, and item homogeneity. The analysis was conducted using the Statistical Package for the Social Sciences (SPSS v.23) based on a preset significant level of 0.05.

RESULTS

Psychometric properties of the scales

3.1 Reliability measures

The internal consistency of the EPDS and BDI-II scales was α =0.865 and 0.90 respectively. Using Lawshe's method, an expert panel of three clinicians evaluated the questionnaire for the necessity of items, their grammar, wording, and scaling. The necessity of each item was assessed using a 3-point rating scale: (a) not necessary, (b) useful but not essential, and (c) essential. The universal agreement between the three ratters was 78% for the EPDS (intra-class correlation coefficient 0.78 [CI 0.16-0. 94]) and 59% for the BDI-II (intra-class correlation coefficient 0.59[CI 0.033-0.9]).

3.2.1 Validity

Using ROC analysis, the area under the curve was calculated at 0.951 (SE=0.02; 95%CI= 0.91-0.99) for EPDS and 0.912 (SE=0.025; 95%CI=0.86–0.96) for BDI (Figure 1).

3.2.2 Cut-offs

Using Youden's index, the following cut-off scores were determined: A score ≥13 on the EPDS (87% sensitivity, 82% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) (Table 1).

3.2.3 Correlation

The correlation established between EPDS and BDI-II was 60%, which represent a weak uphill linear correlation (Figure 2).

3.2 .4 Construct validity

Principle component analyses (PCA) was conducted for the EPDS and BDI-II scales (Figure 3). The analysis suggested that two components of the EPDS explain most of the variance with a cumulative percentage of 58%. The two components were item 2 (sadness) and item 8 (optimism). The convergent construct validity of EPDS was demonstrated through a rotated component matrix of 0.75, which is acceptable and significant (p=0.01). Discriminant validity was supported because no violations were seen in the correlation matrix. Also, the

scree plot of the BDI-II suggests that four components explain most of the variance with a cumulative percentage of 65.2%. These four factors were item 7 (self-dislike), item 2 (pessimistic), item 3 (past failure), and item 6 (punishment feeling). The convergent construct validity of the BDI-II was weak as seen through a rotated component matrix of 0.45. No violations were noted in the correlation matrix, hence supporting discriminant validity. The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy for each factor analysis and it showed to be 0.872 ($p<0.001$).

Table 1: The psychometric properties of the EPDS and BDI-II Scales'

	Cut-off	Sensitivity	Specificity	Corrected classified	LR+	LR-	Youden's index
EPDS	≥8	96%	64%	46.2%	2.66	0.062	60%
	≥9	96%	68%	49.2%	3	0.0058	64%
	≥10	96%	76%	55.6%	4	0.0052	72%
	≥11	90%	83%	62.2%	5.29	0.12	73%
	≥12	87%	88%	69.2%	7.25	0.15	75%
	≥13	87%	90%	77.1%	8.7	0.14	77%
	≥14	71%	99%	84.6%	17.3	0.29	71%
BDI-II	≥18	96%	63%	46%	2.59	0.063	59%
	≥19	96%	73%	51.7%	3.5	0.05	69%
	≥20	90%	76%	53.8%	3.75	0.13	66%
	≥21	90%	77%	54%	3.9	0.12	67%
	≥22	80%	80%	55.6%	4	0.25	60%
	≥23	74%	82%	56.1%	4.1	0.31	56%
	≥24	67%	84%	56.8%	4.18	0.39	51%

Note: EPDS: Edinburgh Postnatal Depression Scale; BDI-II: Beck Depression Inventory; LR: Likelihood ratio

DISCUSSION

Pregnant women should be screened for antenatal depression using an appropriate scale relevant to the local context. Overall, the findings of the current study showed that all the tested screening tools were valid for detecting AD among pregnant women in the country.

Similarly, the two instruments demonstrated narrow confidence intervals. Moreover, the positive predictive values yielded by the EPDS (0.75) were higher than that obtained by the BDI-II (0.54).

Furthermore, the ROC analysis revealed acceptable validity for both scales with the EPDS (AUC = 0.95) showing a higher accuracy than the BDI-II (AUC = 0.91). Thus, the EPDS might be the most convenient screening tool for AD in Qatar. This result is consistent with that of a systematic review on AD screening instruments in low resource settings, which revealed an apparent superiority for EPDS (AUC = 0.96) with a pooled sensitivity of 0.80 and pooled specificity of 0.81.[9] Similarly, a meta-analysis on the reliability and validity of perinatal depression screening instruments in African countries concluded that EPDS was the most reliable and valid tool.[25] On the other hand, the current results oppose those reported from a similar validation study in Brazil, in which the BDI-II was found to be the best-performing screening instrument (AUC=0.9) and showed a higher accuracy than the EPDS (AUC=0.85).[12]

A key question was which cut-off point will reveal the maximum dichotomy between depressed and non-depressed patients and result in further intervention. The current study revealed that the best cut-off value for the EPDS was ≥13, which is consistent with that obtained from studies in Saudi Arabia, Oman, and New Zealand.[3,4,16] Additionally, a score above 13 was identified as the optimal EPDS cut-off point by a recent study in Japan. The study yielded an area under the curve of 0.956 as well as a sensitivity and specificity of 90% and 92.1% respectively.[17] On the other hand, an EPDS cut-off value ≥ 9 was the most optimal in African countries. The aforementioned value was associated with a pooled sensitivity and specificity of 0.94 and 0.77 respectively.[25] Regarding the BDI-II tool, the results showed that a cut-off value ≥19 distinguishes the most between depressed and non-depressed expecting mothers. In contrast, the previously mentioned validation study in Brazil determined an

optimal cut-off value ≥ 16.[12] Also, a much lower BDI score (11/12) was identified as the optimal cut-off point among pregnant women in Taiwan, at which the sensitivity and the specificity were 74% and 83% respectively.[26] Such variation of results across different settings highlights the importance of validation studies to identify the most appropriate screening tool and cut-off value in each population.

In order to minimize the selection bias, the sample taken in this study included pregnant women during all trimesters of pregnancy. This has been supported by the recommendation of the USPSTF which underlines the importance of screening pregnant women for AD regardless of their gestational age.[7] In addition to that, a study conducted in Saudi Arabia found an insignificant difference in the prevalence of AD across different trimesters.[3] However, a study conducted in Korea concluded that the highest prevalence of AD occurred during the third trimester (61.4%).[14] On the other hand, another study from Nigeria determined that the first trimester entailed the higher burden of AD with a prevalence of 27.5%.[15]

This was the first study in the State of Qatar to identify the most suitable screening tool for AD. The sample in the current study was derived from a heterogeneous population of pregnant women, regardless the gestational age, attending nine primary health centers across the country. Furthermore, the investigators were blinded to the results to avoid any interviewer bias. Also, the examined screening tools in the study were compared with the golden standard tool (MINI). Such factors might allow for the universal administration of EPDS as a screening tool in the primary health care setting. Similarly, the construct validity is the top strategy in validating a tool and it was demonstrated in this study.

One of the limitations in this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-*5*) as a tool for diagnosing antenatal depression.[27] The reason behind this

was the need for lengthy appointments, which was not feasible because such action will interrupt the general workflow in the antenatal care clinic of the primary health care center.

In conclusion, the currents study shows that EPDS and BDI-II can be employed as AD screening tools in antenatal clinics at the primary health care level. The EPDS was found to have superior psychometric properties in comparison to the BDI-II tool. Ultimately, the proper use of the aforementioned screening tolls along with their cut-off values will help in the early identification of AD among pregnant women in Qatar, regardless of their trimester. As a result, such step will help raise awareness about antenatal depression and alleviate some of its burden in the country.

Acknowledgments

None.

Competing Interests

The authors declare no conflict of interest.

Funding

None.

Ethical

This study was approved by the Institutional Review Board of the Primary Health Care Corporation under protocol ID (PHCC/RC/18/04/002).

Author contributorship

SN contributed to the conception and planning of the research. All authors contributed equally to the conduct and reporting of the work described in the article.

Data sharing

All data relevant to the study are included in the article.

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Figure legends

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

Figure (2): Correlation graph of the EPDS and BDI-II scales

Figure (3): Scree plots of the EPDS and BDI-II scales

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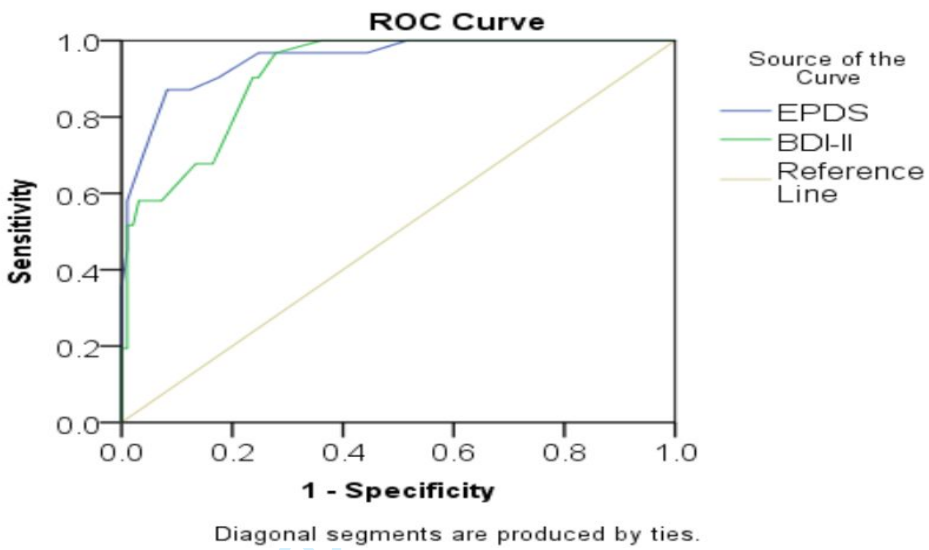


Figure (2): Correlation graph of the EPDS and BDI-II scales

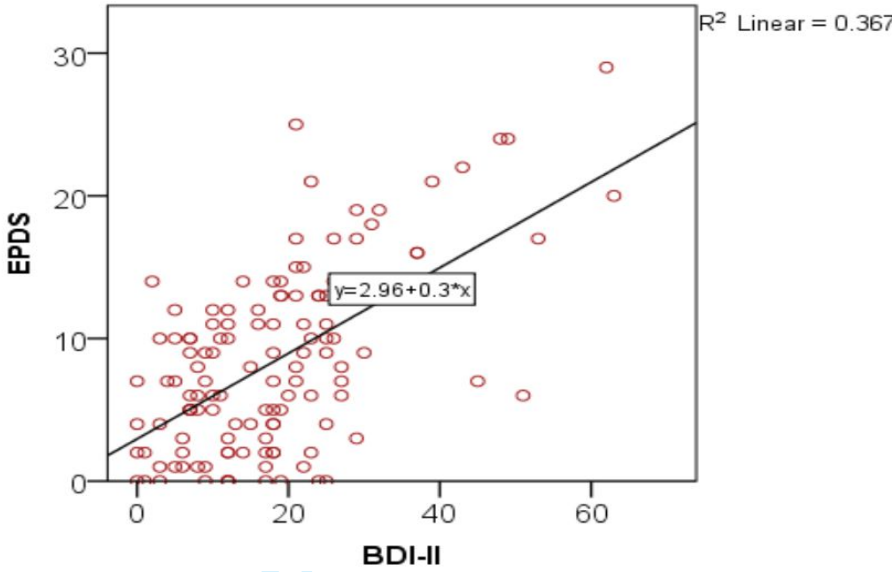
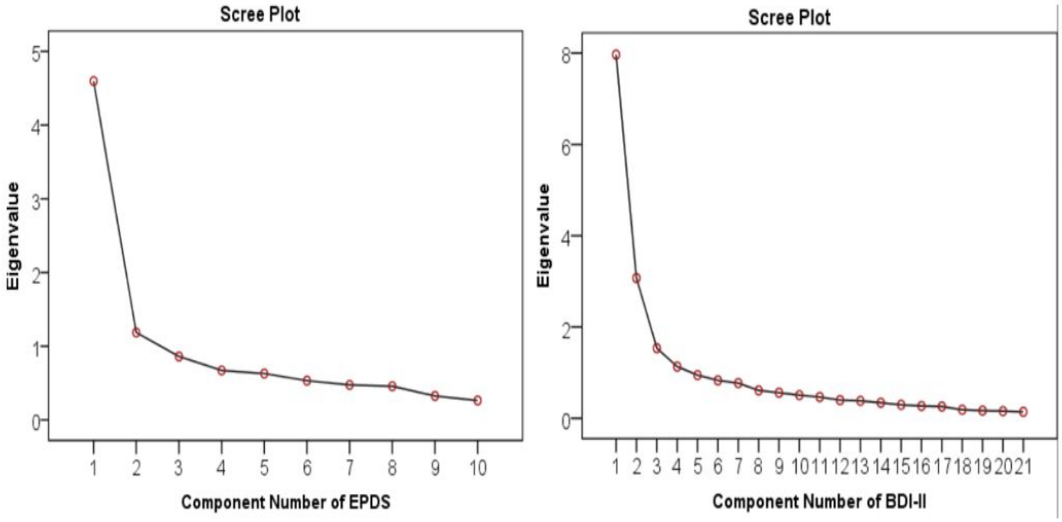


Figure (3): Scree plots of the EPDS and BDI-II scales



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Psychometric properties of the Arabic version of EPDS and BDI-II as a screening tool for antenatal depression: Evidence from Qatar

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Abstract

Objectives: The current study aimed to validate and determine the psychometric properties of the Arabic versions of the Beck Depression Inventory-II (BDI-II) and the Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Design: A cross-sectional study design was employed.

Setting: Antenatal care (ANC) clinics at nine primary health care centers.

Participants: Pregnant women (n=128), aged 15-46 years in different trimesters of pregnancy, attending the ANC clinics as well as capable of reading as well as writing in the Arabic language.

Results: A total of 128 participants were enrolled. Upon conducting the receiver operating characteristic (ROC) analysis, the EPDS showed a larger area under the curve at 0.951 than the BDI-II tool (0.9). Using Youden's index, a score ≥13 on the EPDS (87% sensitivity, 90% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) allowed for the greatest division between depressed and non-depressed participants.

Conclusion: To address the under-recognition of antenatal depression, physicians at primary health care centers in Qatar should be encouraged to utilize the EPDS to screen pregnant women seeking antenatal care services.

Strengths and limitations of this study

- This was the first study in the State of Qatar to identify the most valid screening tool for antenatal depression. Furthermore, the study identified the optimal cut-off points for the Arabic versions of the EPDS and BDI-II among the pregnant population in the country.
- The sample in the current study was derived from a heterogeneous population of pregnant women across the Qatar.
- The examined screening tools in the study were compared with the golden standard (MINI) tool.

- One of the limitations of this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-*5*) as a tool for diagnosing antenatal depression.

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Conflict of Interest: None declared

INTRODUCTION

Globally, maternal mental health problems are considered as a major public health challenge, where depression affects 10% of pregnant women in developed countries and 15.6% in the developing nations (WHO,2017). [1,2] Also, the variation in the prevalence of pregnancy-related depression from one country to another may be justified by the use of different measurement tools and methodologies among the different populations.

High figures were revealed in Arab Gulf countries, where antenatal depression was estimated to impact more than half (57.5%) of expecting mothers in Saudi Arabia and almost a quarter (24%) in Oman during 2016.[3, 4] However, pregnant women with mental disorders can be managed through effective and low-cost interventions after being properly screened by their health care providers.[5, 6]

The United States Preventive Services Task Force (USPSTF) encourages the identification of antenatal depression through screening all gravid women at the primary health care level, given the fact that antenatal depression is a serious, prevalent, and treatable disease (B recommendation).[7] Nevertheless, there is a lack of strong evidence regarding the best screening tool to be employed. [8]

In 2017, a published systematic review compared seven screening tools including the Edinburgh Postnatal Depression Scale (EPDS), Beck Depression Index (BDI-II), Centre for Epidemiologic Studies Depression Scale (CES-D), Hamilton Rating Scale for Depression (HRSD), Hopkins Symptoms Checklist (HSCL), Kessler Psychological Distress Scale (K10), and Self-Reporting Questionnaire (SRQ). The review concluded that the EPDS was the most suitable antenatal depression screening tool in low-resource settings due to its superior level of accuracy and sensitivity. [9]

Debatably, some researchers prefer EPDS as it excludes constitutional symptoms (e.g. changes in sleeping pattern and food habits) in the screening of antenatal depression as such symptoms

are considered uninformative and common in normal pregnancy .[10] On the other hand, some scholars choose BDI-II , arguing that somatic symptoms are valid indicators and these constitutional symptoms should not necessarily be dismissed as normative pregnancy experiences.[11] Given the ease of administrating self-report measures in the clinical and research settings, the decision to include or exclude the aforementioned symptoms is crucial for decision-makers as it will affect their choice of the screening tool.

The identification of an optimal cut-off point could be a key consideration when screening pregnant women especially that literature reveals different cut-off points used among different populations to distinguish between depressed and non-depressed pregnant women. For BDI-II diverse cut-off points were used including a cut-off ≥ 15 in Brazil [12], while higher cut-off point ≥ 16 was used in Washington. [13] Similarly, For EPDS, a cut-off value of ≥10 was employed in Korea [14] and Spain, [15] while ≥11was utilized in Nigeria [16], and >13 in New Zealand as well as Japan.[17,18]. This indicates that there is no international agreement on a specific cut-off value for antenatal depression screening. Furthermore, the adequate determination of this threshold in the screening process is necessary to decrease the false positive and false negative rates and their relevant implications.

Qatar is a country located on the west coast of the Arabian Gulf and a member of the Gulf Cooperation Council (GCC). During the past decade, the country has been home the world's fastest growing population and second-highest migrant population. [19] The Arab population currently constitutes about 27% of the total population (45% are Qatari and 55% are non-Qatari). [20] Based on Qatar's new National Health Strategy (2018-22), there is a focus on preventative strategies among specific vulnerable cohorts such as pregnant women. [21] Thus, the country's main provider of primary health services, the Primary Health Care Corporation, has aligned its corporate strategy with the National Health Strategy and is aiming at better population health through early detection and screening programs by 2023. [(22)]

Unfortunately, there is a lack of evidence regarding the most valid screening tool to detect depression among pregnant women in the country. Thus, the objective of this study is to validate and determine the psychometric properties of the Beck Depression Inventory-II (BDI-II) and the Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Material and Methods

This study is part of a larger project that aimed to measure the prevalence of antenatal depression in Qatar at the Primary Health Care Corporation. The results of the pilot study in relation to the validation of the Arabic version of EPDS and BDI-21 are reported in this paper.

Study setting

This was a cross-sectional study conducted among Arab pregnant women attending the antenatal clinics of the Primary Health Care Corporation (PHCC) in Qatar. The data was collected during both morning and evening work shifts of the health centers and the data collection took place in August and September of 2018.

The primary health centers are the first line of contact between pregnant women and the healthcare system in the country with antenatal participation rate is high as (60%) of the total live births. PHCC provides accessible preventive, promotive, and curative services to the community in Qatar. At the time of the study, there were 23 antenatal clinics across the country and each clinic was operated by a Family Medicine Practitioner.[23]

Sampling Methods or strategy

A cluster random sampling technique was employed. First, the list of the primary health centers that provide antenatal services was obtained from the "Operations Department" at PHCC. The list also included the total number and percentage of pregnant women attending the ANC clinic in each health center and in total (23 centers during the study period). Secondly, the *Automated Random Number Generator* technique was used to select randomly nine health centers out of twenty-three. Thus, each selected health center was designated as a cluster. Finally, the nine

selected health centers were visited by data collectors to enrol eligible participants on a daily basis until fulfilling the quota (n=128).

Patient and public involvement

We did not involve patients or the public in our work.

Sample size and participants

In order to validate the aforementioned screening tools and identify their psychometric properties, the sample size was calculated at 100 to adequately estimate the sensitivity and specificity of the tools; given a margin of error of at most 5% and a 95% confidence interval.[24] To be included in the study, the participants had to be pregnant women (aged 15 -49 years), capable of reading and writing in the Arabic language, and granting a written consent. No restrictions were made regarding the specific trimester of pregnancy.

Research protocol

The eligible pregnant women were first informed about the study and its objectives. After signing the consent form, the participants were briefly interviewed about their demographic and pregnancy-related characteristics. Afterwards, they were asked to complete the self-administrated Arabic versions of the EPDS and BDI-II tools before their scheduled antenatal care visit. Subsequently, the participants would directly undergo the Mini-International Neuropsychiatric Interview (MINI) with the primary care physician during their ANC visit to avoid any unwanted exposure or interference. Also, the aforementioned physicians were blinded to the results of the EPDS and BDI-II tools. Thus, the enrolled pregnant women were assessed for antenatal depression through the three tools during the same visit. As a result, any participant who was diagnosed positive for antenatal depression through the MINI tool was referred to specialised secondary care (psychiatrists) for further evaluation and management.

Data collection tools

- An interview-based and structured questionnaire on sociodemographic and pregnancy-related characteristics (age, nationality, gravidity, trimester, family income, number of children, educational level, occupational status and family size).
- The Edinburgh Postnatal Depression Scale (EPDS) is a self-administrated tool and was first published in the British Journal of Psychiatry during 1987. It consists of 10 items and has been validated for use in different populations. [25]
- The Beck Depression Inventory (BDI-II), first introduced in 1961, is a brief 10-minutes self-administered questionnaire that can detect the presence of depressive symptoms. It consists of 21 questions pertaining to the various aspects of mood such as sadness, suicidal ideation, loss of weight, and social withdrawal.[26]
- The Mini-International Neuropsychiatric Interview (MINI) is a short, diagnostic, and structured interview that is used for diagnosing major Axis I psychiatric disorders in DSM-V and ICD-10. [27] The MINI tool was employed and validated through several studies, particularly for diagnosing depression disorders.[28,29]

Translation

First, the standard English versions of the EPDS and BDI-II tools were retrieved. Then, they were translated to Arabic by a bilingual clinician whose primary language is Arabic and is familiar with the terminology of the area covered by the instrument (Forward translation). Next, a panel consisting of one clinician, a researcher in the field, and the aforementioned translator checked the expressions and concepts of the Arabic version for any discrepancy in comparison to the original English one. Any significant difference was corrected in consensus and the final Arabic versions were translated back to English by an independent bilingual clinician whose mother tongue was English. After the back-translation ensured the accuracy of the translated versions, they were piloted on a sample of 20 pregnant women. The pilot testing aimed to check

if the Arabic versions were clear and understandable among study subjects as well as interviewers, where the piloted sample was excluded from analyses.

Statistical analysis

- The socio-demographic and clinical characteristics were summarized using descriptive statistics in the form of means and standard deviations for quantitative variables as well as frequency and percentages for categorical variables. Additionally, bivariate analyses were conducted through the chi-square or Fisher's exact tests to compare the association between the dependent (antenatal depression) and independent variable (socio-demographic and clinical characteristics).
- The receiver operating characteristic (ROC) analysis was employed to measure the accuracy of the EPDS and BDI-II in diagnosing major depression according to DSM-V criteria. Afterwards, Youden's index *(J= Sensitivity+ Specificity -1)* was used to determinate the best cut-off points for antenatal depression screening. Also, Cronbach's alpha (α) was employed as an estimate of scale reliability, internal consistency, and item homogeneity.
- To examine the concordance among the psychometric scales tested, the Pearson correlation coefficient (r) was calculated. In addition, a Principal Component Analysis (PCA) was carried out on the EPDS and BDI-II tools to identify subsets the components of the tools contributing to the most of the variance. The convergent construct validity of the EPDS was demonstrated through a rotated component matrix (varimax rotation). The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy.
- The analysis was conducted using the Statistical Package for the Social Sciences (SPSS v.23) based on a preset significant level of 0.05.

RESULTS

3.1 Demographic characteristics

One hundred and twenty-eight (128) pregnant women matched the inclusion criteria and accepted to participate in the current study. Table 1 presents the background characteristics of the study participants, where most of the pregnant women were non-Qatari Arabs (82%), holding a diploma or university degree (70%), unemployed (55%), with a monthly family income >10,000 QR (75%), multigravid (71%), and in the second trimester of their pregnancy (48%). Additionally, the mean age of the participants was 28.8 (SD=5 years).

Table 1: Socio demographic and clinical characteristics of the study sample (n=128)

	MINI-diagnostic		Total (n)	χ^2	*p* value
	Positive n (%)	**Negative n (%)**			
Age (years)					
20-34	31(26)	87(74)	118	0.87	**0.46**
35-46	4 (40)	6(60)	10		
Nationality					
Qatari	6(23.1)	17(73.9)	23	0.053	**0.817**
Other Arabs	25(23.8)	80(79.2)	105		
Trimester					
1st trimester	8(29.6)	19(70.4)	27	1.56	**0.457**
2nd trimester	12(19.4)	50(80.6)	62		
3rd trimester	11(28.2)	28(71.8)	39		
Gravida					
Primigravida	10(73)	27(27.8)	37	0.224	**0.636**
Multigravida	21(23.1)	70(76.9)	91		
Family Monthly income (QR)					
< 10.000 QR	7(22.6)	24(77.4)	31	4.5	**0.1**
10.000 - < 20.000 QR	20(37)	34(63)	54		
≥ 20.000 **QR**	8(18.6)	35(81.4)	43		
Number of children					
zero	10(26.3)	28(73.7)	38	1.48	**0.685**
[1-3]	19(22.9)	64(77.1)	83		
[4-5]	2(40)	3(60)	5		
≥ 6	0(0)	2(100)	2		
Educational level*					
Higher education	18(20)	72(80)	90		
Secondary education	7(25.9)	20(74.1)	27	9.1	**0.027***
Primary education	6(54.5)	5(45.5)	11		

Occupational Status					
Housewife	20(28.2)	51(71.8)	71		
Employed	8(17.4)	38(82.6)	46	1.828	**0.4**
Student	3(27.3)	8(27.7)	11		
Family size*					
Small family size(<5)	11(14.7)	64(85.3)	75	11.63	**0.003***
Average family size(=5)	10(50)	10(50)	20		
Large family size(>5)	10(30.3)	23(69.7)	33		

* $p \leq 0.05$/a=Fisher test/ Chi-square *SD: Standard Deviation - QR: Qatari Riyals*

3.2. Psychometric properties of the scales

3.2.1. Reliability

The internal consistency of the EPDS and BDI-II scales was calculated at α =0.865 and 0.90 respectively. Using Lawshe's method, an expert panel of three clinicians evaluated the questionnaire for the necessity of items, their grammar, wording, and scaling. The necessity of each item was assessed using a 3-point rating scale: (a) not necessary, (b) useful but not essential, and (c) essential. The universal agreement between the three raters was 78% for the EPDS (intra-class correlation coefficient 0.78 [CI 0.16-0. 94]) and 59% for the BDI-II (intra-class correlation coefficient 0.59[CI 0.033-0.9]).

3.2.2. Cut-offs

Based on Youden's index, the following cut-off scores were determined: A score ≥13 on the EPDS (87% sensitivity, 90% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) (Table 2).

Table 2: The psychometric properties of the EPDS and BDI-II Scales

	Cut-off	Sensitivity	Specificity	Corrected classified	LR+	LR-	Youden's Index
EPDS	≥8	96%	64%	46.2%	2.66	0.062	60%
	≥9	96%	68%	49.2%	3	0.0058	64%
	≥10	96%	76%	55.6%	4	0.0052	72%
	≥11	90%	83%	62.2%	5.29	0.12	73%
	≥12	87%	88%	69.2%	7.25	0.15	75%

	≥13	87%	90%	77.1%	8.7	0.14	77%
	≥14	71%	99%	84.6%	17.3	0.29	71%
BDI-II	≥18	96%	63%	46%	2.59	0.063	59%
	≥19	96%	73%	51.7%	3.5	0.05	69%
	≥20	90%	76%	53.8%	3.75	0.13	66%
	≥21	90%	77%	54%	3.9	0.12	67%
	≥22	80%	80%	55.6%	4	0.25	60%
	≥23	74%	82%	56.1%	4.1	0.31	56%
	≥24	67%	84%	56.8%	4.18	0.39	51%

Note: EPDS: Edinburgh Postnatal Depression Scale; BDI-II: Beck Depression Inventory; LR: Likelihood ratio

3.2.3 Validity

Using ROC analysis, the area under the curve (AUC) was calculated at 0.951 (SE=0.02; 95%CI= 0.91-0.99) for EPDS and 0.912 (SE=0.025; 95%CI=0.86–0.96) for BDI (Figure 1).

3.2.4 Correlation

The correlation established between EPDS and BDI-II was 60% which represent a weak uphill linear correlation (Figure 2).

3.2 .5 Construct validity

Principle component analyses (PCA) was conducted for the EPDS and BDI-II scales (Figure 3). The analysis suggested that two components of the EPDS explain most of the variance with a cumulative percentage of 58%. The two components were item 2 (sadness) and item 8 (optimism). The convergent construct validity of EPDS was demonstrated through a rotated component matrix of 0.75, which is acceptable and significant (p=0.01). Discriminant validity was supported because no violations were seen in the correlation matrix. Also, the scree plot of the BDI-II suggests that four components explain most of the variance with a cumulative percentage of 65.2%. These four factors were item 7 (self-dislike), item 2 (pessimistic), item 3 (past failure), and item 6 (punishment feeling). The convergent construct validity of the BDI-II was weak as seen through a rotated component matrix of 0.45. No violations were noted in

the correlation matrix, hence supporting discriminant validity. The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy for each factor analysis and it showed to be 0.872 ($p<0.001$).

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

Figure (2): Correlation between EPDS and BDI-II

Figure (3): Scree plots of EPDS and BDI-II

DISCUSSION

In the current study, a similar prevalence rate of antenatal depression was found through the EPDS and MINI-interview tools at 27.3% and 24% respectively. However, the BDI -II detected a higher prevalence at 45.3%. Overall, the EPDS was found to be superior to the BDI-II because the positive predictive value of the former (0.75) was much higher than that of the latter (0.54). Given that the positive predictive value could be influenced by the actual prevalence of the disease, the likehood ratio was calculated and revealed that the EPDS had a higher positive likelihood ratio, nearly triple that of the BDI-II. Additionally, the EPDS showed a higher Youden's Index. So, the EPDS demonstrated a better performance and was the more useful screening tool for antenatal depression in Qatar.

The previously mentioned result is consistent with that of a systematic review on AD screening instruments across low resource settings, which revealed an apparent superiority for EPDS (AUC = 0.96) with a pooled sensitivity and specificity of 0.80 and 0.81 respectively.[9] Similarly, a meta-analysis on the reliability and validity of perinatal depression screening instruments for perinatal depression in African countries concluded that the EPDS was the most reliable and valid tool.[30] On the other hand, the current results oppose those reported from a similar validation study in Brazil, where the BDI-II was found to be the best-performing screening instrument (AUC=0.9) and showed higher accuracy than the EPDS (AUC=0.85).[12] In addition to that, a key question was which cut-off point will reveal the maximum dichotomy between the depressed and non-depressed patients and result in further intervention. The

current study revealed that the best cut-off value for the EPDS was ≥13, which is consistent with that obtained from studies in Saudi Arabia, Oman, and New Zealand.[3,4,17] Additionally, a score above 13 was identified as the optimal EPDS cut-off point by a recent study in Japan. On the other hand, the study yielded an area under the curve of 0.956 as well as a sensitivity and specificity of 90% and 92.1% respectively.[18]whereas, an EPDS cut-off value ≥ 9 was the most optimal in African countries. The aforementioned value was associated with a pooled sensitivity and specificity of 0.94 and 0.77 respectively.[30] Another study in Spain showed that EPDS cut-off value ≥ 10 (AUC of 0.76, sensitivity of 72.4%, specificity of 79.3%, PPV of 18.2%, NPV of 97.8%, and OA of 78.9%).[15]

Regarding the BDI-II tool, the results showed that a cut-off value ≥19 distinguishes the most between depressed and non-depressed expecting mothers. In contrast, the previously mentioned validation study in Brazil determined that the optimal cut-off value was ≥ 16.[12] Also, a much lower BDI score (11/12) was identified as the optimal cut-off point among pregnant women in Taiwan, at which the sensitivity and the specificity were 74% and 83% respectively.[31] Such variation of results across different settings highlights the importance of validation studies to identify the most appropriate screening tool and associated cut-off value in each population.

In order to minimize the selection bias, the sample taken in this study included pregnant women during all trimesters of pregnancy in the first (21%), second (48%), and third (30%) trimester of pregnancy. This has been supported by the recommendation of the USPSTF which underlines the importance of screening pregnant women for antenatal depression regardless of their gestational age.[7] In addition to that, a study conducted in Saudi Arabia found an insignificant difference in the prevalence of antenatal depression across different trimesters.[3] However, a study conducted in Korea concluded that the highest prevalence of antenatal depression occurred during the third trimester (61.4%).[15] On the other hand, another study from

Nigeria determined that the first trimester entailed the higher burden of antenatal depression with a prevalence of 27.5%.[16]

This was the first study in the State of Qatar to identify the most suitable screening tool for antenatal depression. The study sample in the current study was derived from a heterogeneous population of pregnant women, regardless the gestational age, attending nine primary health centers across the country. Furthermore, the investigators were blinded to the results to avoid any interviewer bias. Also, the examined screening tools in the study were compared with the golden standard tool (MINI). Similarly, the construct validity of the EPDS has been demonstrated in the current study. The aforementioned factors allow for the universal administration of the EPDS as a screening tool in Qatar's primary health care setting. One of the limitations in this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-5) as a tool for diagnosing antenatal depression.[32] The reason behind this was the need for lengthy appointments, which was not feasible because such action will interrupt the general workflow at the antenatal care clinic of the primary health care center.

In conclusion, the currents study shows that the EPDS is superior to BDI-II as an antenatal depression screening tool at the primary health care level in Qatar. The EPDS was found to have better psychometric properties in comparison to the BDI-II tool. Ultimately, the proper use of the aforementioned screening tools along with their cut-off values will help in the early identification of AD among pregnant women in Qatar. As a result, such step will help raise awareness about antenatal depression and alleviate some of its burden in the country.

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None.

Competing Interests

The authors declare no conflict of interest.

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None.

Ethical

This study was approved by the Institutional Review Board of the Primary Health Care Corporation under protocol ID (PHCC/RC/18/06/002).

Author contributor ship

SN designed the study, performed the statistical analysis, interpretation of the results and drafted the manuscript. NAK and IB helped in designing the study. MC and AA helped in data analysis and participated in the preparation of the manuscript. NA helped in data collection, entry, and interpretation. All authors revised and approved the final version of the manuscript. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved.

Data sharing

All data relevant to the study are included in the article.

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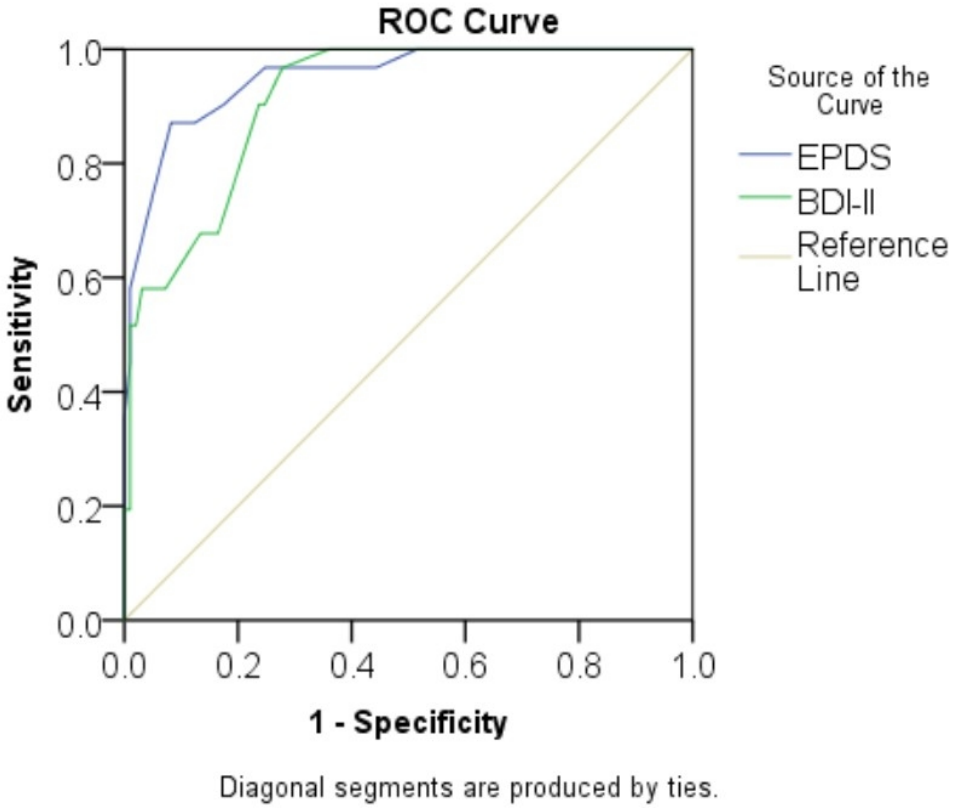

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

124x101mm (168 x 168 DPI)

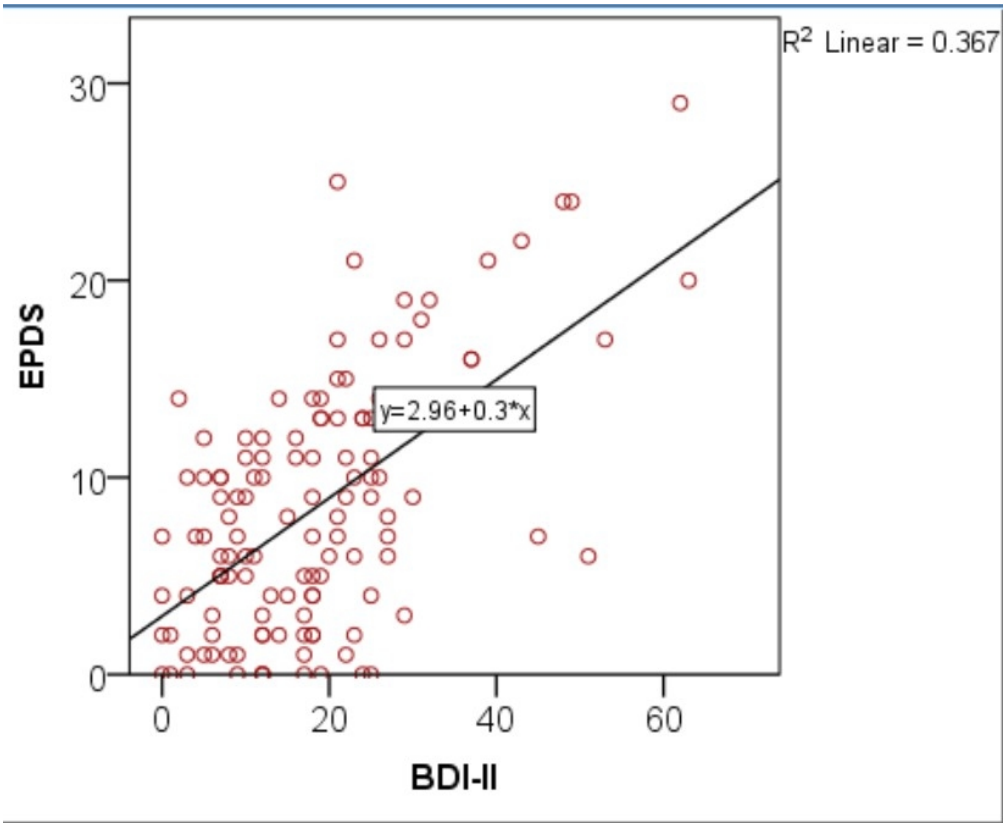

Figure (2): Correlation graph of the EPDS and BDI-II scales

123x101mm (168 x 168 DPI)

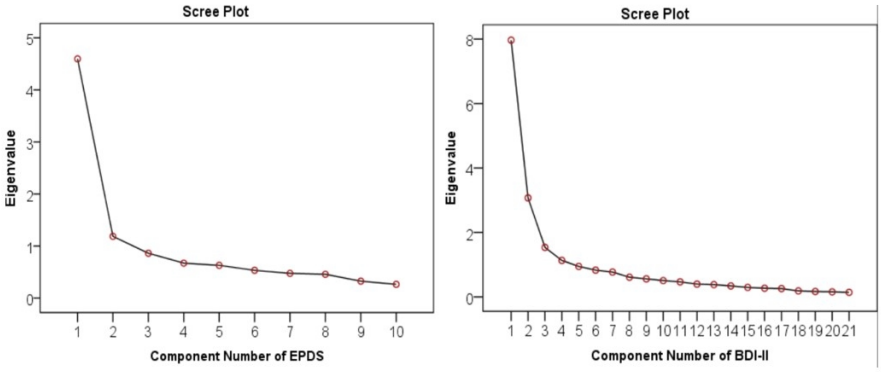

Figure (3): Scree plots of the EPDS and BDI-II scales

177x81mm (168 x 168 DPI)

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Psychometric properties of the Arabic version of EPDS and BDI-II as a screening tool for antenatal depression: Evidence from Qatar

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Psychometric properties of the Arabic version of EPDS and BDI-II as a screening tool for antenatal depression: Evidence from Qatar

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Abstract

Objectives: The current study aimed to validate and determine the psychometric properties of the Arabic versions of the Beck Depression Inventory-II (BDI-II) and the Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Design: A cross-sectional study design was employed.

Setting: Antenatal care (ANC) clinics at nine primary health care centers.

Participants: Pregnant women (n=128), aged 15-46 years in different trimesters of pregnancy, attending the ANC clinics as well as capable of reading as well as writing in the Arabic language.

Results: A total of 128 participants were enrolled. Upon conducting the receiver operating characteristic (ROC) analysis, the EPDS showed a larger area under the curve at 0.951 than the BDI-II tool (0.9). Using Youden's index, a score ≥13 on the EPDS (87% sensitivity, 90% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) allowed for the greatest division between depressed and non-depressed participants.

Conclusion: To address the under-recognition of antenatal depression, physicians at primary health care centers in Qatar should be encouraged to utilize the EPDS to screen pregnant women seeking antenatal care services.

Strengths and limitations of this study

- This was the first study in the State of Qatar to identify the most valid screening tool for antenatal depression. Furthermore, the study identified the optimal cut-off points for the Arabic versions of the EPDS and BDI-II among the pregnant population in the country.
- The sample in the current study was derived from a heterogeneous population of pregnant women across the Qatar.
- The examined screening tools in the study were compared with the golden standard (MINI) tool.

- One of the limitations of this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-*5*) as a tool for diagnosing antenatal depression.

Keywords: mental health; antenatal depression; validation studies; Edinburgh Postnatal Depression Scale; Beck Depression Inventory-II; Mini International Neuropsychiatric Interview

Conflict of Interest: None declared

INTRODUCTION

Globally, maternal mental health problems are considered as a major public health challenge, where depression affects 10% of pregnant women in developed countries and 15.6% in the developing nations (WHO,2017). [1,2] Also, the variation in the prevalence of pregnancy-related depression from one country to another may be justified by the use of different measurement tools and methodologies among the different populations.

High figures were revealed in Arab Gulf countries, where antenatal depression was estimated to impact more than half (57.5%) of expecting mothers in Saudi Arabia and almost a quarter (24%) in Oman during 2016.[3, 4] However, pregnant women with mental disorders can be managed through effective and low-cost interventions after being properly screened by their health care providers.[5, 6]

The United States Preventive Services Task Force (USPSTF) encourages the identification of antenatal depression through screening all gravid women at the primary health care level, given the fact that antenatal depression is a serious, prevalent, and treatable disease (B recommendation).[7] Nevertheless, there is a lack of strong evidence regarding the best screening tool to be employed. [8]

In 2017, a published systematic review compared seven screening tools including the Edinburgh Postnatal Depression Scale (EPDS), Beck Depression Index (BDI-II), Centre for Epidemiologic Studies Depression Scale (CES-D), Hamilton Rating Scale for Depression (HRSD), Hopkins Symptoms Checklist (HSCL), Kessler Psychological Distress Scale (K10), and Self-Reporting Questionnaire (SRQ). The review concluded that the EPDS was the most suitable antenatal depression screening tool in low-resource settings due to its superior level of accuracy and sensitivity. [9]

Debatably, some researchers prefer EPDS as it excludes constitutional symptoms (e.g. changes in sleeping pattern and food habits) in the screening of antenatal depression as such

symptoms are considered uninformative and common in normal pregnancy .[10] On the other hand, some scholars choose BDI-II , arguing that somatic symptoms are valid indicators and these constitutional symptoms should not necessarily be dismissed as normative pregnancy experiences.[11] Given the ease of administrating self-report measures in the clinical and research settings, the decision to include or exclude the aforementioned symptoms is crucial for decision-makers as it will affect their choice of the screening tool.

The identification of an optimal cut-off point could be a key consideration when screening pregnant women especially that literature reveals different cut-off points used among different populations to distinguish between depressed and non-depressed pregnant women. For BDI-II diverse cut-off points were used including a cut-off ≥ 15 in Brazil [12], while higher cut-off point ≥ 16 was used in Washington. [13] Similarly, For EPDS, a cut-off value of ≥10 was employed in Korea [14] and Spain, [15] while ≥11was utilized in Nigeria [16], and >13 in New Zealand as well as Japan.[17,18]. This indicates that there is no international agreement on a specific cut-off value for antenatal depression screening. Furthermore, the adequate determination of this threshold in the screening process is necessary to decrease the false positive and false negative rates and their relevant implications.

Qatar is a country located on the west coast of the Arabian Gulf and a member of the Gulf Cooperation Council (GCC). During the past decade, the country has been home the world's fastest growing population and second-highest migrant population. [19] The Arab population currently constitutes about 27% of the total population (45% are Qatari and 55% are non-Qatari). [20] Based on Qatar's new National Health Strategy (2018-22), there is a focus on preventative strategies among specific vulnerable cohorts such as pregnant women. [21] Thus, the country's main provider of primary health services, the Primary Health Care Corporation, has aligned its corporate strategy with the National Health Strategy and is aiming at better population health through early detection and screening programs by 2023. [(22)]

Unfortunately, there is a lack of evidence regarding the most valid screening tool to detect depression among pregnant women in the country. Thus, the objective of this study is to validate and determine the psychometric properties of the Beck Depression Inventory-II (BDI-II) and the Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Material and Methods

This study is part of a larger project that aimed to measure the prevalence of antenatal depression in Qatar at the Primary Health Care Corporation. The results of the pilot study in relation to the validation of the Arabic version of EPDS and BDI-21 are reported in this paper.

Study setting

This was a cross-sectional study conducted among Arab pregnant women attending the antenatal clinics of the Primary Health Care Corporation (PHCC) in Qatar. The data was collected during both morning and evening work shifts of the health centers and the data collection took place in August and September of 2018.

The primary health centers are the first line of contact between pregnant women and the healthcare system in the country with antenatal participation rate is high as (60%) of the total live births. PHCC provides accessible preventive, promotive, and curative services to the community in Qatar. At the time of the study, there were 23 antenatal clinics across the country and each clinic was operated by a Family Medicine Practitioner.[23]

Sampling Methods or strategy

A cluster random sampling technique was employed. First, the list of the primary health centers that provide antenatal services was obtained from the "Operations Department" at PHCC. The list also included the total number and percentage of pregnant women attending the ANC clinic in each health center and in total (23 centers during the study period). Secondly, the *Automated Random Number Generator* technique was used to select randomly

nine health centers out of twenty-three. Thus, each selected health center was designated as a cluster. Finally, the nine selected health centers were visited by data collectors to enrol eligible participants on a daily basis until fulfilling the quota (n=128).

Patient and public involvement

We did not involve patients or the public in our work.

Sample size and participants

In order to validate the aforementioned screening tools and identify their psychometric properties, the sample size was calculated at 100 to adequately estimate the sensitivity and specificity of the tools; given a margin of error of at most 5% and a 95% confidence interval.[24] To be included in the study, the participants had to be pregnant women (aged 15 - 49 years), capable of reading and writing in the Arabic language, and granting a written consent. No restrictions were made regarding the specific trimester of pregnancy.

Research protocol

The eligible pregnant women were first informed about the study and its objectives. After signing the consent form, the participants were briefly interviewed about their demographic and pregnancy-related characteristics. Afterwards, they were asked to complete the self-administrated Arabic versions of the EPDS and BDI-II tools before their scheduled antenatal care visit. Subsequently, the participants would directly undergo the Mini-International Neuropsychiatric Interview (MINI) with the primary care physician during their ANC visit to avoid any unwanted exposure or interference. Also, the aforementioned physicians were blinded to the results of the EPDS and BDI-II tools. Thus, the enrolled pregnant women were assessed for antenatal depression through the three tools during the same visit. As a result, any participant who was diagnosed positive for antenatal depression through the MINI tool

was referred to specialised secondary care (psychiatrists) for further evaluation and management.

Data collection tools

- An interview-based and structured questionnaire on sociodemographic and pregnancy-related characteristics (age, nationality, gravidity, trimester, family income, number of children, educational level, occupational status and family size).
- The Edinburgh Postnatal Depression Scale (EPDS) is a self-administrated tool and was first published in the British Journal of Psychiatry during 1987. It consists of 10 items and has been validated for use in different populations. [25]
- The Beck Depression Inventory (BDI-II), first introduced in 1961, is a brief 10-minutes self-administered questionnaire that can detect the presence of depressive symptoms. It consists of 21 questions pertaining to the various aspects of mood such as sadness, suicidal ideation, loss of weight, and social withdrawal.[26]
- The Mini-International Neuropsychiatric Interview (MINI) is a short, diagnostic, and structured interview that is used for diagnosing major Axis I psychiatric disorders in DSM-V and ICD-10. [27] The MINI tool was employed and validated through several studies, particularly for diagnosing depression disorders.[28,29]

Translation

First, the standard English versions of the EPDS and BDI-II tools were retrieved. Then, they were translated to Arabic by a bilingual clinician whose primary language is Arabic and is familiar with the terminology of the area covered by the instrument (Forward translation). Next, a panel consisting of one clinician, a researcher in the field, and the aforementioned translator checked the expressions and concepts of the Arabic version for any discrepancy in comparison to the original English one. Any significant difference was corrected in

consensus and the final Arabic versions were translated back to English by an independent bilingual clinician whose mother tongue was English. After the back-translation ensured the accuracy of the translated versions, they were piloted on a sample of 20 pregnant women. The pilot testing aimed to check if the Arabic versions were clear and understandable among study subjects as well as interviewers, where the piloted sample was excluded from analyses.

Statistical analysis

- The socio-demographic and clinical characteristics were summarized using descriptive statistics in the form of means and standard deviations for quantitative variables as well as frequency and percentages for categorical variables. Additionally, bivariate analyses were conducted through the chi-square or Fisher's exact tests to compare the association between the dependent (antenatal depression) and independent variable (socio-demographic and clinical characteristics).
- The receiver operating characteristic (ROC) analysis was employed to measure the accuracy of the EPDS and BDI-II in diagnosing major depression according to DSM-V criteria. Afterwards, Youden's index *(J= Sensitivity+ Specificity -1)* was used to determinate the best cut-off points for antenatal depression screening. Also, Cronbach's alpha (α) was employed as an estimate of scale reliability, internal consistency, and item homogeneity.
- To examine the concordance among the psychometric scales tested, the Pearson correlation coefficient (r) was calculated. In addition, a Principal Component Analysis (PCA) was carried out on the EPDS and BDI-II tools to identify subsets the components of the tools contributing to the most of the variance. The convergent construct validity of the EPDS was demonstrated through a rotated component matrix (varimax rotation). The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy.

- The analysis was conducted using the Statistical Package for the Social Sciences (SPSS v.23) based on a preset significant level of .05.

RESULTS

3.1 Demographic characteristics

One hundred and twenty-eight (128) pregnant women matched the inclusion criteria and accepted to participate in the current study. Table 1 presents the background characteristics of the study participants, where most of the pregnant women were non-Qatari Arabs (82%), holding a diploma or university degree (70%), unemployed (55%), with a monthly family income >10,000 QR (75%), multigravid (71%), and in the second trimester of their pregnancy (48%). Additionally, the mean age of the participants was 28.8 (SD=5 years).

Table 1: Socio demographic and clinical characteristics of the study sample (n=128)

	MINI-diagnostic		Total (n)	χ^2	*p* value
	Positive n (%)	**Negative n (%)**			
Age (years)					
20-34	31(26)	87(74)	118	0.87	**0.46**
35-46	4 (40)	6(60)	10		
Nationality					
Qatari	6(23.1)	17(73.9)	23	0.053	**0.817**
Other Arabs	25(23.8)	80(79.2)	105		
Trimester					
1st trimester	8(29.6)	19(70.4)	27	1.56	**0.457**
2nd trimester	12(19.4)	50(80.6)	62		
3rd trimester	11(28.2)	28(71.8)	39		
Gravida					
Primigravida	10(73)	27(27.8)	37	0.224	**0.636**
Multigravida	21(23.1)	70(76.9)	91		
Family Monthly income (QR)					
< 10.000 QR	7(22.6)	24(77.4)	31	4.5	**0.1**
10.000 - < 20.000 QR	20(37)	34(63)	54		
≥ 20.000 **QR**	8(18.6)	35(81.4)	43		

Number of children					
zero	10(26.3)	28(73.7)	38	1.48	**0.685**
[1-3]	19(22.9)	64(77.1)	83		
[4-5]	2(40)	3(60)	5		
≥ 6	0(0)	2(100)	2		
Educational level*					
Higher education	18(20)	72(80)	90		
Secondary education	7(25.9)	20(74.1)	27	9.1	**0.027***
Primary education	6(54.5)	5(45.5)	11		
Occupational Status					
Housewife	20(28.2)	51(71.8)	71		
Employed	8(17.4)	38(82.6)	46	1.828	**0.4**
Student	3(27.3)	8(27.7)	11		
Family size*					
Small family size(<5)	11(14.7)	64(85.3)	75	11.63	**0.003***
Average family size(=5)	10(50)	10(50)	20		
Large family size(>5)	10(30.3)	23(69.7)	33		

* $p \leq .05$/a=Fisher test/ Chi-square *SD: Standard Deviation - QR: Qatari Riyals*

3.2. Psychometric properties of the scales

3.2.1. Reliability

The internal consistency of the EPDS and BDI-II scales was calculated at α =0.865 and 0.90 respectively. Using Lawshe's method, an expert panel of three clinicians evaluated the questionnaire for the necessity of items, their grammar, wording, and scaling. The necessity of each item was assessed using a 3-point rating scale: (a) not necessary, (b) useful but not essential, and (c) essential. The universal agreement between the three raters was 78% for the EPDS (intra-class correlation coefficient r= 0.78 [CI 0.16-0. 94]) and 59% for the BDI-II (intra-class correlation coefficient r= 0.59[CI 0.033-0.9]).

3.2.2. Cut-offs

Based on Youden's index, the following cut-off scores were determined: A score ≥13 on the EPDS (87% sensitivity, 90% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) (Table 2).

Table 2: The psychometric properties of the EPDS and BDI-II Scales

	Cut-off	Sensitivity	Specificity	Corrected classified	LR+	LR-	Youden's Index
EPDS	≥8	96%	64%	46.2%	2.66	0.062	60%
	≥9	96%	68%	49.2%	3	0.0058	64%
	≥10	96%	76%	55.6%	4	0.0052	72%
	≥11	90%	83%	62.2%	5.29	0.12	73%
	≥12	87%	88%	69.2%	7.25	0.15	75%
	≥13	87%	90%	77.1%	8.7	0.14	77%
	≥14	71%	99%	84.6%	17.3	0.29	71%
BDI-II	≥18	96%	63%	46%	2.59	0.063	59%
	≥19	96%	73%	51.7%	3.5	0.05	69%
	≥20	90%	76%	53.8%	3.75	0.13	66%
	≥21	90%	77%	54%	3.9	0.12	67%
	≥22	80%	80%	55.6%	4	0.25	60%
	≥23	74%	82%	56.1%	4.1	0.31	56%
	≥24	67%	84%	56.8%	4.18	0.39	51%

Note: EPDS: Edinburgh Postnatal Depression Scale; BDI-II: Beck Depression Inventory; LR: Likelihood ratio

3.2.3 Validity

Using ROC analysis, the area under the curve (AUC) was calculated at 0.951 (SE=0.02; 95%CI= 0.91-0.99) for EPDS and 0.912 (SE=0.025; 95%CI=0.86–0.96) for BDI (Figure 1).

3.2.4 Correlation

The correlation established between EPDS and BDI-II was 60% which represent a weak uphill linear correlation (Figure 2).

3.2 .5 Construct validity

Principle component analyses (PCA) was conducted for the EPDS and BDI-II scales (Figure 3). The analysis suggested that two components of the EPDS explain most of the variance with a cumulative percentage of 58%. The two components were item 2 (sadness) and item 8 (optimism). The convergent construct validity of EPDS was demonstrated through a rotated component matrix of 0.75, which is acceptable and significant (p=0.01). Discriminant

validity was supported because no violations were seen in the correlation matrix. Also, the scree plot of the BDI-II suggests that four components explain most of the variance with a cumulative percentage of 65.2%. These four factors were item 7 (self-dislike), item 2 (pessimistic), item 3 (past failure), and item 6 (punishment feeling). The convergent construct validity of the BDI-II was weak as seen through a rotated component matrix of 0.45. No violations were noted in the correlation matrix, hence supporting discriminant validity. The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy for each factor analysis and it showed to be 0.872 ($p<0.001$).

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

Figure (2): Correlation between EPDS and BDI-II

Figure (3): Scree plots of EPDS and BDI-II

DISCUSSION

In the current study, a similar prevalence rate of antenatal depression was found through the EPDS and MINI-interview tools at 27.3% and 24% respectively. However, the BDI -II detected a higher prevalence at 45.3%. Overall, the EPDS was found to be superior to the BDI-II because the positive predictive value of the former (0.75) was much higher than that of the latter (0.54).

Given that the positive predictive value could be influenced by the actual prevalence of the disease, the likehood ratio was calculated and revealed that the EPDS had a higher positive likelihood ratio, nearly triple that of the BDI-II. Additionally, the EPDS showed a higher Youden's Index. So, the EPDS demonstrated a better performance and was the more useful screening tool for antenatal depression in Qatar.

The previously mentioned result is consistent with that of a systematic review on AD screening instruments across low resource settings, which revealed an apparent superiority for EPDS (AUC = 0.96) with a pooled sensitivity and specificity of 0.80 and 0.81 respectively.[9] Similarly, a meta-analysis on the reliability and validity of perinatal depression

screening instruments for perinatal depression in African countries concluded that the EPDS was the most reliable and valid tool.[30] On the other hand, the current results oppose those reported from a similar validation study in Brazil, where the BDI-II was found to be the best-performing screening instrument (AUC=0.9) and showed higher accuracy than the EPDS (AUC=0.85).[12]

In addition to that, a key question was which cut-off point will reveal the maximum dichotomy between the depressed and non-depressed patients and result in further intervention. The current study revealed that the best cut-off value for the EPDS was ≥13, which is consistent with that obtained from studies in Saudi Arabia, Oman, and New Zealand.[3,4,17] Additionally, a score above 13 was identified as the optimal EPDS cut-off point by a recent study in Japan. On the other hand, the study yielded an area under the curve of 0.956 as well as a sensitivity and specificity of 90% and 92.1% respectively.[18]whereas, an EPDS cut-off value ≥ 9 was the most optimal in African countries. The aforementioned value was associated with a pooled sensitivity and specificity of 0.94 and 0.77 respectively.[30] Another study in Spain showed that EPDS cut-off value ≥ 10 (AUC of 0.76, sensitivity of 72.4%, specificity of 79.3%, PPV of 18.2%, NPV of 97.8%, and OA of 78.9%).[15]

Regarding the BDI-II tool, the results showed that a cut-off value ≥19 distinguishes the most between depressed and non-depressed expecting mothers. In contrast, the previously mentioned validation study in Brazil determined that the optimal cut-off value was ≥ 16.[12] Also, a much lower BDI score (11/12) was identified as the optimal cut-off point among pregnant women in Taiwan, at which the sensitivity and the specificity were 74% and 83% respectively.[31] Such variation of results across different settings highlights the importance of validation studies to identify the most appropriate screening tool and associated cut-off value in each population.

In order to minimize the selection bias, the sample taken in this study included pregnant women during all trimesters of pregnancy in the first (21%), second (48%), and third (30%) trimester of pregnancy. This has been supported by the recommendation of the USPSTF which underlines the importance of screening pregnant women for antenatal depression regardless of their gestational age.[7] In addition to that, a study conducted in Saudi Arabia found an insignificant difference in the prevalence of antenatal depression across different trimesters.[3] However, a study conducted in Korea concluded that the highest prevalence of antenatal depression occurred during the third trimester (61.4%).[14] On the other hand, another study from Nigeria determined that the first trimester entailed the higher burden of antenatal depression with a prevalence of 27.5%.[16]

This was the first study in the State of Qatar to identify the most suitable screening tool for antenatal depression. The study sample in the current study was derived from a heterogeneous population of pregnant women, regardless the gestational age, attending nine primary health centers across the country. Furthermore, the investigators were blinded to the results to avoid any interviewer bias. Also, the examined screening tools in the study were compared with the golden standard tool (MINI). Similarly, the construct validity of the EPDS has been demonstrated in the current study. The aforementioned factors allow for the universal administration of the EPDS as a screening tool in Qatar's primary health care setting. One of the limitations in this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-5) as a tool for diagnosing antenatal depression.[32] The reason behind this was the need for lengthy appointments, which was not feasible because such action will interrupt the general workflow at the antenatal care clinic of the primary health care center.

In conclusion, the currents study shows that the EPDS is superior to BDI-II as an antenatal depression screening tool at the primary health care level in Qatar. The EPDS was found to

have better psychometric properties in comparison to the BDI-II tool. Ultimately, the proper use of the aforementioned screening tools along with their cut-off values will help in the early identification of AD among pregnant women in Qatar. As a result, such step will help raise awareness about antenatal depression and alleviate some of its burden in the country.

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None.

Competing Interests

The authors declare no conflict of interest.

Funding

None.

Ethical

This study was approved by the Institutional Review Board of the Primary Health Care Corporation under protocol ID (PHCC/RC/18/06/002).

Author contributor ship

SN designed the study, performed the statistical analysis, interpretation of the results and drafted the manuscript. NAK and IB helped in designing the study. MC and AA helped in data analysis and participated in the preparation of the manuscript. NA helped in data collection, entry, and interpretation. All authors revised and approved the final version of the manuscript. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved.

Data sharing

All data relevant to the study are included in the article.

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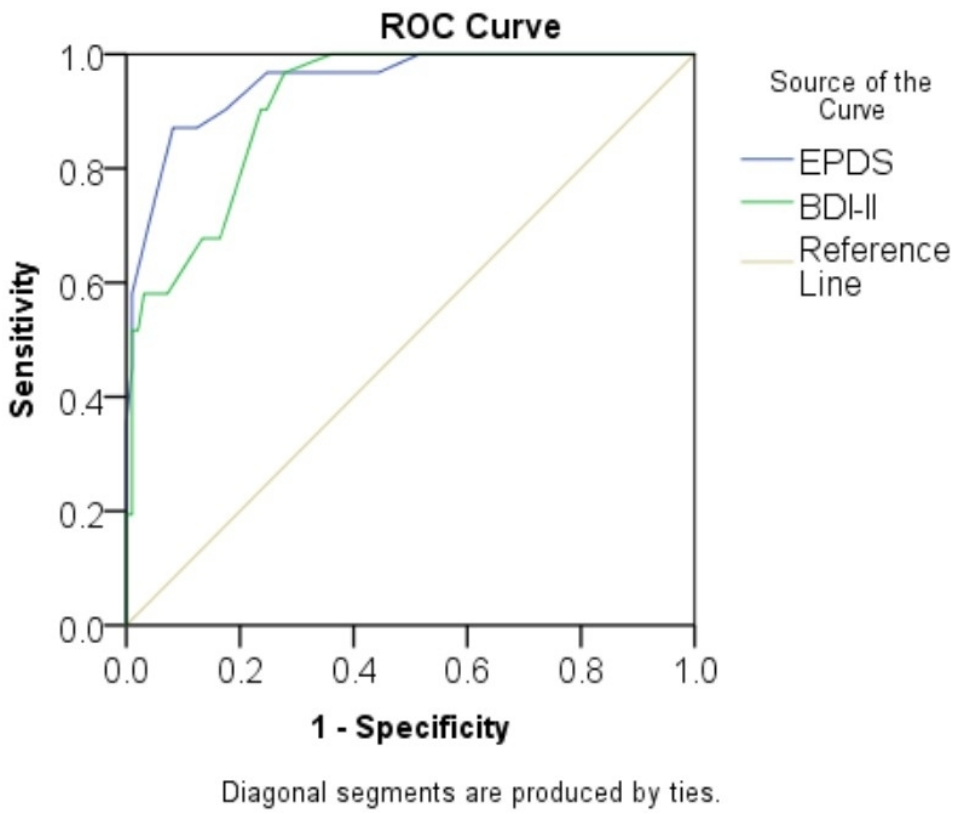

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

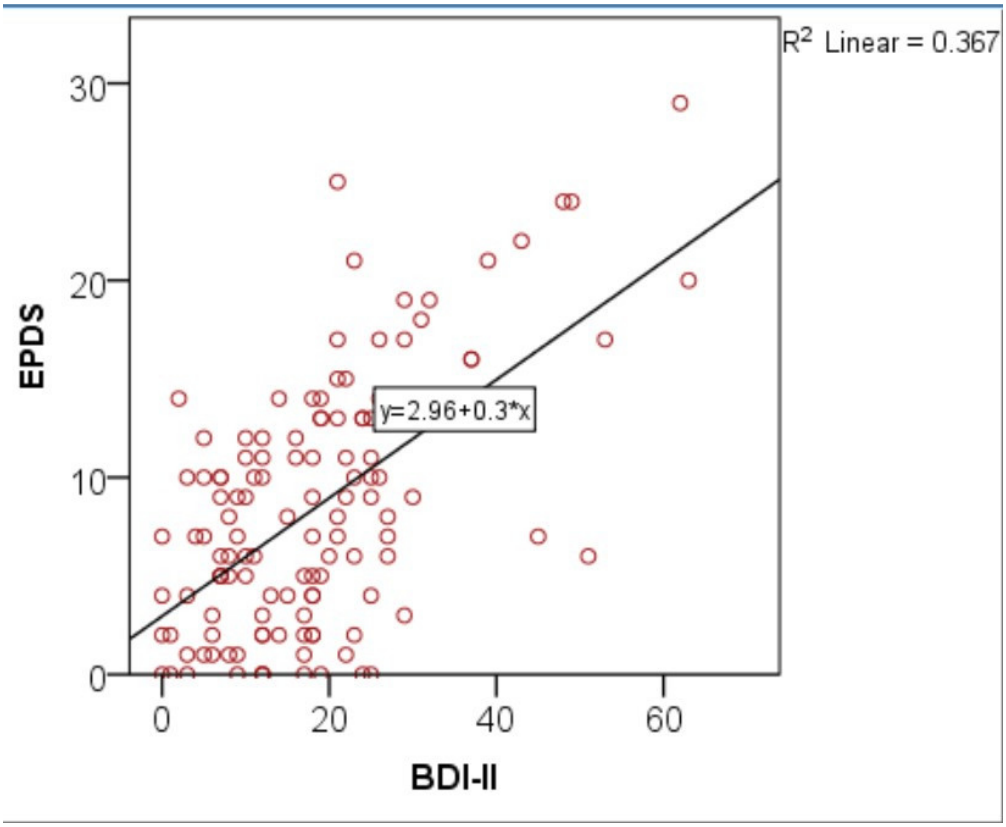

Figure (2): Correlation graph of the EPDS and BDI-II scales

69x56mm (300 x 300 DPI)

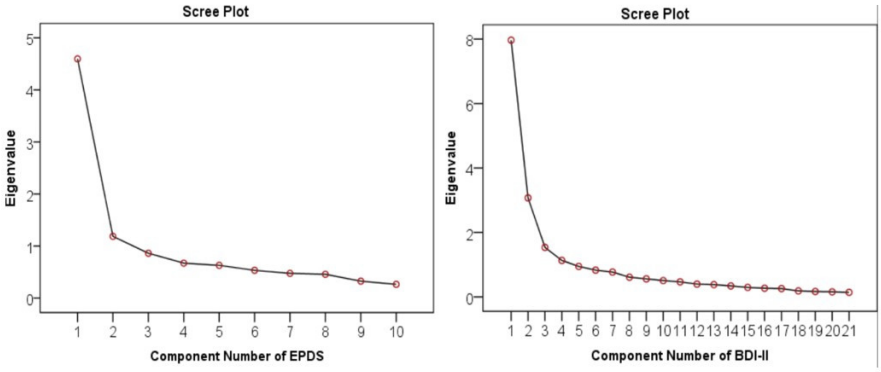

Figure (3): Scree plots of the EPDS and BDI-II scales

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Psychometric properties of the Arabic version of EPDS and BDI-II as a screening tool for antenatal depression: Evidence from Qatar

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Psychometric properties of the Arabic version of EPDS and BDI-II as a screening tool for antenatal depression: Evidence from Qatar

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Abstract

Objectives: The current study aimed to validate and determine the psychometric properties of the Arabic versions of the Beck Depression Inventory-II (BDI-II) and the Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Design: A cross-sectional study design was employed.

Setting: Antenatal care (ANC) clinics at nine primary health care centers.

Participants: Pregnant women (n=128), aged 15-46 years in different trimesters of pregnancy, attending the ANC clinics as well as capable of reading as well as writing in the Arabic language.

Results: A total of 128 participants were enrolled. Upon conducting the receiver operating characteristic (ROC) analysis, the EPDS showed a larger area under the curve at 0.951 than the BDI-II tool (0.9). Using Youden's index, a score ≥13 on the EPDS (87% sensitivity, 90% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) allowed for the greatest division between depressed and non-depressed participants.

Conclusion: To address the under-recognition of antenatal depression, physicians at primary health care centers in Qatar should be encouraged to utilize the EPDS to screen pregnant women seeking antenatal care services.

Strengths and limitations of this study

- This was the first study in the State of Qatar to identify the most valid screening tool for antenatal depression. Furthermore, the study identified the optimal cut-off points for the Arabic versions of the EPDS and BDI-II among the pregnant population in the country.
- The sample in the current study was derived from a heterogeneous population of pregnant women across the Qatar.
- The examined screening tools in the study were compared with the golden standard (MINI) tool.

- One of the limitations of this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-*5*) as a tool for diagnosing antenatal depression.

Keywords: mental health; antenatal depression; validation studies; Edinburgh Postnatal Depression Scale; Beck Depression Inventory-II; Mini International Neuropsychiatric Interview

Conflict of Interest: None declared

INTRODUCTION

Globally, maternal mental health problems are considered as a major public health challenge, where depression affects 10% of pregnant women in developed countries and 15.6% in the developing nations (WHO,2017). [1,2] Also, the variation in the prevalence of pregnancy-related depression from one country to another may be justified by the use of different measurement tools and methodologies among the different populations.

High figures were revealed in Arab Gulf countries, where antenatal depression was estimated to impact more than half (57.5%) of expecting mothers in Saudi Arabia and almost a quarter (24%) in Oman during 2016.[3, 4] However, pregnant women with mental disorders can be managed through effective and low-cost interventions after being properly screened by their health care providers.[5, 6]

The United States Preventive Services Task Force (USPSTF) encourages the identification of antenatal depression through screening all gravid women at the primary health care level, given the fact that antenatal depression is a serious, prevalent, and treatable disease (B recommendation).[7] Nevertheless, there is a lack of strong evidence regarding the best screening tool to be employed. [8]

In 2017, a published systematic review compared seven screening tools including the Edinburgh Postnatal Depression Scale (EPDS), Beck Depression Index (BDI-II), Centre for Epidemiologic Studies Depression Scale (CES-D), Hamilton Rating Scale for Depression (HRSD), Hopkins Symptoms Checklist (HSCL), Kessler Psychological Distress Scale (K10), and Self-Reporting Questionnaire (SRQ). The review concluded that the EPDS was the most suitable antenatal depression screening tool in low-resource settings due to its superior level of accuracy and sensitivity. [9]

Debatably, some researchers prefer EPDS as it excludes constitutional symptoms (e.g. changes in sleeping pattern and food habits) in the screening of antenatal depression as such

symptoms are considered uninformative and common in normal pregnancy .[10] On the other hand, some scholars choose BDI-II , arguing that somatic symptoms are valid indicators and these constitutional symptoms should not necessarily be dismissed as normative pregnancy experiences.[11] Given the ease of administrating self-report measures in the clinical and research settings, the decision to include or exclude the aforementioned symptoms is crucial for decision-makers as it will affect their choice of the screening tool.

The identification of an optimal cut-off point could be a key consideration when screening pregnant women especially that literature reveals different cut-off points used among different populations to distinguish between depressed and non-depressed pregnant women. For BDI-II diverse cut-off points were used including a cut-off ≥ 15 in Brazil [12], while higher cut-off point ≥ 16 was used in Washington. [13] Similarly, For EPDS, a cut-off value of ≥10 was employed in Korea [14] and Spain, [15] while ≥11was utilized in Nigeria [16], and >13 in New Zealand as well as Japan.[17,18]. This indicates that there is no international agreement on a specific cut-off value for antenatal depression screening. Furthermore, the adequate determination of this threshold in the screening process is necessary to decrease the false positive and false negative rates and their relevant implications.

Qatar is a country located on the west coast of the Arabian Gulf and a member of the Gulf Cooperation Council (GCC). During the past decade, the country has been home the world's fastest growing population and second-highest migrant population. [19] The Arab population currently constitutes about 27% of the total population (45% are Qatari and 55% are non-Qatari). [20] Based on Qatar's new National Health Strategy (2018-22), there is a focus on preventative strategies among specific vulnerable cohorts such as pregnant women. [21] Thus, the country's main provider of primary health services, the Primary Health Care Corporation, has aligned its corporate strategy with the National Health Strategy and is aiming at better population health through early detection and screening programs by 2023. [(22)]

Unfortunately, there is a lack of evidence regarding the most valid screening tool to detect depression among pregnant women in the country. Thus, the objective of this study is to validate and determine the psychometric properties of the Beck Depression Inventory-II (BDI-II) and the Edinburgh Postnatal Depression Scale (EPDS) in Qatar.

Material and Methods

This study is part of a larger project that aimed to measure the prevalence of antenatal depression in Qatar at the Primary Health Care Corporation. The results of the pilot study in relation to the validation of the Arabic version of EPDS and BDI-21 are reported in this paper.

Study setting

This was a cross-sectional study conducted among Arab pregnant women attending the antenatal clinics of the Primary Health Care Corporation (PHCC) in Qatar. The data was collected during both morning and evening work shifts of the health centers and the data collection took place in August and September of 2018.

The primary health centers are the first line of contact between pregnant women and the healthcare system in the country with antenatal participation rate is high as (60%) of the total live births. PHCC provides accessible preventive, promotive, and curative services to the community in Qatar. At the time of the study, there were 23 antenatal clinics across the country and each clinic was operated by a Family Medicine Practitioner.[23]

Sampling Methods or strategy

A cluster random sampling technique was employed. First, the list of the primary health centers that provide antenatal services was obtained from the "Operations Department" at PHCC. The list also included the total number and percentage of pregnant women attending the ANC clinic in each health center and in total (23 centers during the study period). Secondly, the *Automated Random Number Generator* technique was used to select randomly

nine health centers out of twenty-three. Thus, each selected health center was designated as a cluster. Finally, the nine selected health centers were visited by data collectors to enrol eligible participants on a daily basis until fulfilling the quota (n=128).

Patient and public involvement

We did not involve patients or the public in our work.

Sample size and participants

In order to validate the aforementioned screening tools and identify their psychometric properties, the sample size was calculated at 100 to adequately estimate the sensitivity and specificity of the tools; given a margin of error of at most 5% and a 95% confidence interval.[24] To be included in the study, the participants had to be pregnant women (aged 15 - 49 years), capable of reading and writing in the Arabic language, and granting a written consent. No restrictions were made regarding the specific trimester of pregnancy.

Research protocol

The eligible pregnant women were first informed about the study and its objectives. After signing the consent form, the participants were briefly interviewed about their demographic and pregnancy-related characteristics. Afterwards, they were asked to complete the self-administrated Arabic versions of the EPDS and BDI-II tools before their scheduled antenatal care visit. Subsequently, the participants would directly undergo the Mini-International Neuropsychiatric Interview (MINI) with the primary care physician during their ANC visit to avoid any unwanted exposure or interference. Also, the aforementioned physicians were blinded to the results of the EPDS and BDI-II tools. Thus, the enrolled pregnant women were assessed for antenatal depression through the three tools during the same visit. As a result, any participant who was diagnosed positive for antenatal depression through the MINI tool

was referred to specialised secondary care (psychiatrists) for further evaluation and management.

Data collection tools

- An interview-based and structured questionnaire on sociodemographic and pregnancy-related characteristics (age, nationality, gravidity, trimester, family income, number of children, educational level, occupational status and family size).
- The Edinburgh Postnatal Depression Scale (EPDS) is a self-administrated tool and was first published in the British Journal of Psychiatry during 1987. It consists of 10 items and has been validated for use in different populations. [25]
- The Beck Depression Inventory (BDI-II), first introduced in 1961, is a brief 10-minutes self-administered questionnaire that can detect the presence of depressive symptoms. It consists of 21 questions pertaining to the various aspects of mood such as sadness, suicidal ideation, loss of weight, and social withdrawal.[26]
- The Mini-International Neuropsychiatric Interview (MINI) is a short, diagnostic, and structured interview that is used for diagnosing major Axis I psychiatric disorders in DSM-V and ICD-10. [27] The MINI tool was employed and validated through several studies, particularly for diagnosing depression disorders.[28,29]

Translation

First, the standard English versions of the EPDS and BDI-II tools were retrieved. Then, they were translated to Arabic by a bilingual clinician whose primary language is Arabic and is familiar with the terminology of the area covered by the instrument (Forward translation). Next, a panel consisting of one clinician, a researcher in the field, and the aforementioned translator checked the expressions and concepts of the Arabic version for any discrepancy in comparison to the original English one. Any significant difference was corrected in

consensus and the final Arabic versions were translated back to English by an independent bilingual clinician whose mother tongue was English. After the back-translation ensured the accuracy of the translated versions, they were piloted on a sample of 20 pregnant women. The pilot testing aimed to check if the Arabic versions were clear and understandable among study subjects as well as interviewers, where the piloted sample was excluded from analyses.

Statistical analysis

- The socio-demographic and clinical characteristics were summarized using descriptive statistics in the form of means and standard deviations for quantitative variables as well as frequency and percentages for categorical variables. Additionally, bivariate analyses were conducted through the chi-square or Fisher's exact tests to compare the association between the dependent (antenatal depression) and independent variable (socio-demographic and clinical characteristics).
- The receiver operating characteristic (ROC) analysis was employed to measure the accuracy of the EPDS and BDI-II in diagnosing major depression according to DSM-V criteria. Afterwards, Youden's index *(J= Sensitivity+ Specificity -1)* was used to determinate the best cut-off points for antenatal depression screening. Also, Cronbach's alpha (α) was employed as an estimate of scale reliability, internal consistency, and item homogeneity.
- To examine the concordance among the psychometric scales tested, the Pearson correlation coefficient (r) was calculated. In addition, a Principal Component Analysis (PCA) was carried out on the EPDS and BDI-II tools to identify subsets the components of the tools contributing to the most of the variance. The convergent construct validity of the EPDS was demonstrated through a rotated component matrix (varimax rotation). The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy.

- The analysis was conducted using the Statistical Package for the Social Sciences (SPSS v.23) based on a preset significant level of .05.

RESULTS

3.1 Demographic characteristics

One hundred and twenty-eight (128) pregnant women matched the inclusion criteria and accepted to participate in the current study. Table 1 presents the background characteristics of the study participants, where most of the pregnant women were non-Qatari Arabs (82%), holding a diploma or university degree (70%), unemployed (55%), with a monthly family income >10,000 QR (75%), multigravid (71%), and in the second trimester of their pregnancy (48%). Additionally, the mean age of the participants was 28.8 (SD=5 years).

Table 1: Socio demographic and clinical characteristics of the study sample (n=128)

	MINI-diagnostic		Total (n)	χ^2	*p* value
	Positive n (%)	**Negative n (%)**			
Age (years)					
20-34	31(26)	87(74)	118	0.87	**0.46**
35-46	4 (40)	6(60)	10		
Nationality					
Qatari	6(23.1)	17(73.9)	23	0.053	**0.817**
Other Arabs	25(23.8)	80(79.2)	105		
Trimester					
1st trimester	8(29.6)	19(70.4)	27	1.56	**0.457**
2nd trimester	12(19.4)	50(80.6)	62		
3rd trimester	11(28.2)	28(71.8)	39		
Gravida					
Primigravida	10(73)	27(27.8)	37	0.224	**0.636**
Multigravida	21(23.1)	70(76.9)	91		
Family Monthly income (QR)					
< 10.000 QR	7(22.6)	24(77.4)	31	4.5	**0.1**
10.000 - < 20.000 QR	20(37)	34(63)	54		
≥ 20.000 **QR**	8(18.6)	35(81.4)	43		

Number of children					
zero	10(26.3)	28(73.7)	38	1.48	**0.685**
[1-3]	19(22.9)	64(77.1)	83		
[4-5]	2(40)	3(60)	5		
≥ 6	0(0)	2(100)	2		
Educational level*					
Higher education	18(20)	72(80)	90		
Secondary education	7(25.9)	20(74.1)	27	9.1	**0.027***
Primary education	6(54.5)	5(45.5)	11		
Occupational Status					
Housewife	20(28.2)	51(71.8)	71		
Employed	8(17.4)	38(82.6)	46	1.828	**0.4**
Student	3(27.3)	8(27.7)	11		
Family size*					
Small family size(<5)	11(14.7)	64(85.3)	75	11.63	**0.003***
Average family size(=5)	10(50)	10(50)	20		
Large family size(>5)	10(30.3)	23(69.7)	33		

* $p \leq .05$/a=Fisher test/ Chi-square *SD: Standard Deviation - QR: Qatari Riyals*

3.2. Psychometric properties of the scales

3.2.1. Reliability

The internal consistency of the EPDS and BDI-II scales was calculated at α =0.865 and 0.90 respectively. Using Lawshe's method, an expert panel of three clinicians evaluated the questionnaire for the necessity of items, their grammar, wording, and scaling. The necessity of each item was assessed using a 3-point rating scale: (a) not necessary, (b) useful but not essential, and (c) essential. The universal agreement between the three raters was 78% for the EPDS (intra-class correlation coefficient r= 0.78 [CI 0.16-0. 94]) and 59% for the BDI-II (intra-class correlation coefficient r= 0.59[CI 0.033-0.9]).

3.2.2. Cut-offs

Based on Youden's index, the following cut-off scores were determined: A score ≥13 on the EPDS (87% sensitivity, 90% specificity) and ≥ 19 on the BDI-II (96% sensitivity, 73% specificity) (Table 2).

Table 2: The psychometric properties of the EPDS and BDI-II Scales

	Cut-off	Sensitivity	Specificity	Corrected classified	LR+	LR-	Youden's Index
EPDS	≥8	96%	64%	46.2%	2.66	0.062	60%
	≥9	96%	68%	49.2%	3	0.0058	64%
	≥10	96%	76%	55.6%	4	0.0052	72%
	≥11	90%	83%	62.2%	5.29	0.12	73%
	≥12	87%	88%	69.2%	7.25	0.15	75%
	≥13	87%	90%	77.1%	8.7	0.14	77%
	≥14	71%	99%	84.6%	17.3	0.29	71%
BDI-II	≥18	96%	63%	46%	2.59	0.063	59%
	≥19	96%	73%	51.7%	3.5	0.05	69%
	≥20	90%	76%	53.8%	3.75	0.13	66%
	≥21	90%	77%	54%	3.9	0.12	67%
	≥22	80%	80%	55.6%	4	0.25	60%
	≥23	74%	82%	56.1%	4.1	0.31	56%
	≥24	67%	84%	56.8%	4.18	0.39	51%

Note: EPDS: Edinburgh Postnatal Depression Scale; BDI-II: Beck Depression Inventory; LR: Likelihood ratio

3.2.3 Validity

Using ROC analysis, the area under the curve (AUC) was calculated at 0.951 (SE=0.02; 95%CI= 0.91-0.99) for EPDS and 0.912 (SE=0.025; 95%CI=0.86–0.96) for BDI (Figure 1).

3.2.4 Correlation

The correlation established between EPDS and BDI-II was 60% which represent a weak uphill linear correlation (Figure 2). Thus, the explained variance will be 36%.

3.2 .5 Construct validity

Principle component analyses (PCA) was conducted for the EPDS and BDI-II scales (Figure 3). The analysis suggested that two components of the EPDS explain most of the variance with a cumulative percentage of 58%. The two components were item 2 (sadness) and item 8 (optimism). The convergent construct validity of EPDS was demonstrated through a rotated component matrix of 0.75, which is acceptable and significant (p=0.01). Discriminant

validity was supported because no violations were seen in the correlation matrix. Also, the scree plot of the BDI-II suggests that four components explain most of the variance with a cumulative percentage of 65.2%. These four factors were item 7 (self-dislike), item 2 (pessimistic), item 3 (past failure), and item 6 (punishment feeling). The convergent construct validity of the BDI-II was weak as seen through a rotated component matrix of 0.45. No violations were noted in the correlation matrix, hence supporting discriminant validity. The Kaiser-Meyer-Olkin (KMO) values were considered for measuring sampling adequacy for each factor analysis and it showed to be 0.872 ($p<0.001$).

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

Figure (2): Correlation between EPDS and BDI-II

Figure (3): Scree plots of EPDS and BDI-II

DISCUSSION

In the current study, a similar prevalence rate of antenatal depression was found through the EPDS and MINI-interview tools at 27.3% and 24% respectively. However, the BDI -II detected a higher prevalence at 45.3%. Overall, the EPDS was found to be superior to the BDI-II because the positive predictive value of the former (0.75) was much higher than that of the latter (0.54).

Given that the positive predictive value could be influenced by the actual prevalence of the disease, the likelihood ratio was calculated and revealed that the EPDS had a higher positive likelihood ratio, nearly triple that of the BDI-II. Additionally, the EPDS showed a higher Youden's Index. So, the EPDS demonstrated a better performance and was the more useful screening tool for antenatal depression in Qatar.

The previously mentioned result is consistent with that of a systematic review on AD screening instruments across low resource settings, which revealed an apparent superiority for EPDS (AUC = 0.96) with a pooled sensitivity and specificity of 0.80 and 0.81 respectively.[9] Similarly, a meta-analysis on the reliability and validity of perinatal depression

screening instruments for perinatal depression in African countries concluded that the EPDS was the most reliable and valid tool.[30] On the other hand, the current results oppose those reported from a similar validation study in Brazil, where the BDI-II was found to be the best-performing screening instrument (AUC=0.9) and showed higher accuracy than the EPDS (AUC=0.85).[12]

In addition to that, a key question was which cut-off point will reveal the maximum dichotomy between the depressed and non-depressed patients and result in further intervention. The current study revealed that the best cut-off value for the EPDS was ≥13, which is consistent with that obtained from studies in Saudi Arabia, Oman, and New Zealand.[3,4,17] Additionally, a score above 13 was identified as the optimal EPDS cut-off point by a recent study in Japan. On the other hand, the study yielded an area under the curve of 0.956 as well as a sensitivity and specificity of 90% and 92.1% respectively.[18]whereas, an EPDS cut-off value ≥ 9 was the most optimal in African countries. The aforementioned value was associated with a pooled sensitivity and specificity of 0.94 and 0.77 respectively.[30] Another study in Spain showed that EPDS cut-off value ≥ 10 (AUC of 0.76, sensitivity of 72.4%, specificity of 79.3%, PPV of 18.2%, NPV of 97.8%, and OA of 78.9%).[15]

Regarding the BDI-II tool, the results showed that a cut-off value ≥19 distinguishes the most between depressed and non-depressed expecting mothers. In contrast, the previously mentioned validation study in Brazil determined that the optimal cut-off value was ≥ 16.[12] Also, a much lower BDI score (11/12) was identified as the optimal cut-off point among pregnant women in Taiwan, at which the sensitivity and the specificity were 74% and 83% respectively.[31] Such variation of results across different settings highlights the importance of validation studies to identify the most appropriate screening tool and associated cut-off value in each population.

In order to minimize the selection bias, the sample taken in this study included pregnant women during all trimesters of pregnancy in the first (21%), second (48%), and third (30%) trimester of pregnancy. This has been supported by the recommendation of the USPSTF which underlines the importance of screening pregnant women for antenatal depression regardless of their gestational age.[7] In addition to that, a study conducted in Saudi Arabia found an insignificant difference in the prevalence of antenatal depression across different trimesters.[3] However, a study conducted in Korea concluded that the highest prevalence of antenatal depression occurred during the third trimester (61.4%).[14] On the other hand, another study from Nigeria determined that the first trimester entailed the higher burden of antenatal depression with a prevalence of 27.5%.[16]

This was the first study in the State of Qatar to identify the most suitable screening tool for antenatal depression. The study sample in the current study was derived from a heterogeneous population of pregnant women, regardless the gestational age, attending nine primary health centers across the country. Furthermore, the investigators were blinded to the results to avoid any interviewer bias. Also, the examined screening tools in the study were compared with the golden standard tool (MINI). Similarly, the construct validity of the EPDS has been demonstrated in the current study. The aforementioned factors allow for the universal administration of the EPDS as a screening tool in Qatar's primary health care setting. One of the limitations in this study was the inability to use the Structured Clinical Interview for DSM-5 (SCID-5) as a tool for diagnosing antenatal depression.[32] The reason behind this was the need for lengthy appointments, which was not feasible because such action will interrupt the general workflow at the antenatal care clinic of the primary health care center.

In conclusion, the currents study shows that the EPDS is superior to BDI-II as an antenatal depression screening tool at the primary health care level in Qatar. The EPDS was found to

have better psychometric properties in comparison to the BDI-II tool. Ultimately, the proper use of the aforementioned screening tools along with their cut-off values will help in the early identification of AD among pregnant women in Qatar. As a result, such step will help raise awareness about antenatal depression and alleviate some of its burden in the country.

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Competing Interests

The authors declare no conflict of interest.

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None.

Ethical

This study was approved by the Institutional Review Board of the Primary Health Care Corporation under protocol ID (PHCC/RC/18/06/002).

Author contributor ship

SN designed the study, performed the statistical analysis, interpretation of the results and drafted the manuscript. NAK and IB helped in designing the study. MC and AA helped in data analysis and participated in the preparation of the manuscript. NA helped in data collection, entry, and interpretation. All authors revised and approved the final version of the manuscript. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved.

Data sharing

All data relevant to the study are included in the article.

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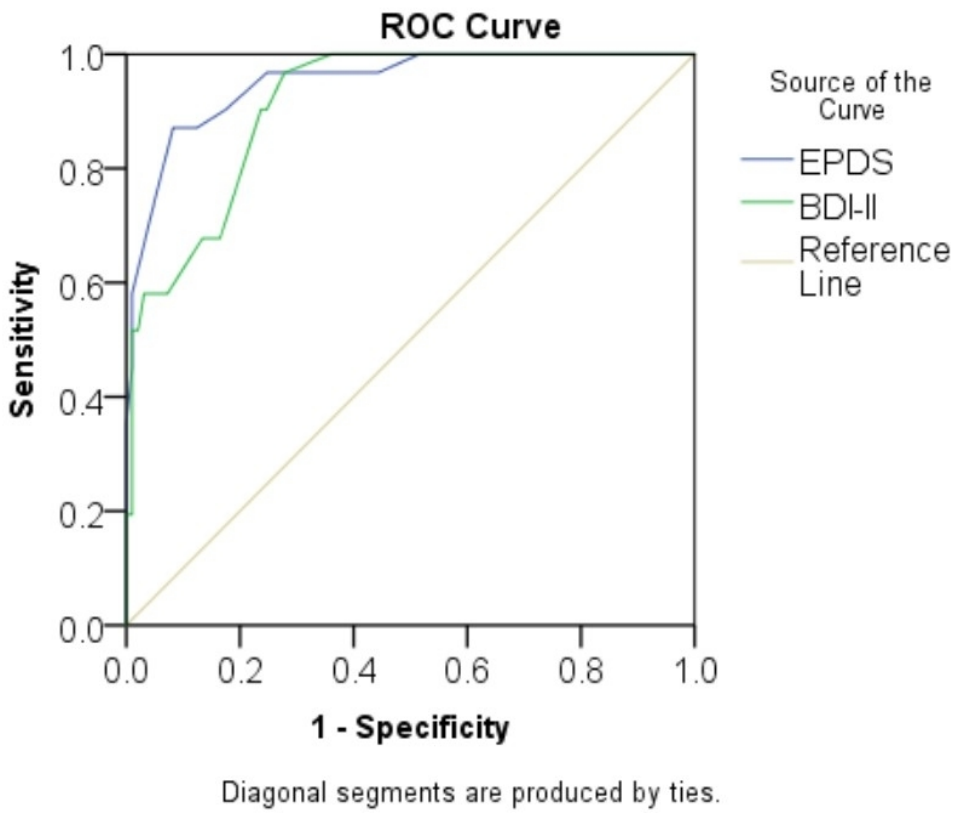

Figure (1): Receiving operating characteristic (ROC) curves of the EPDS and BDI-II scales

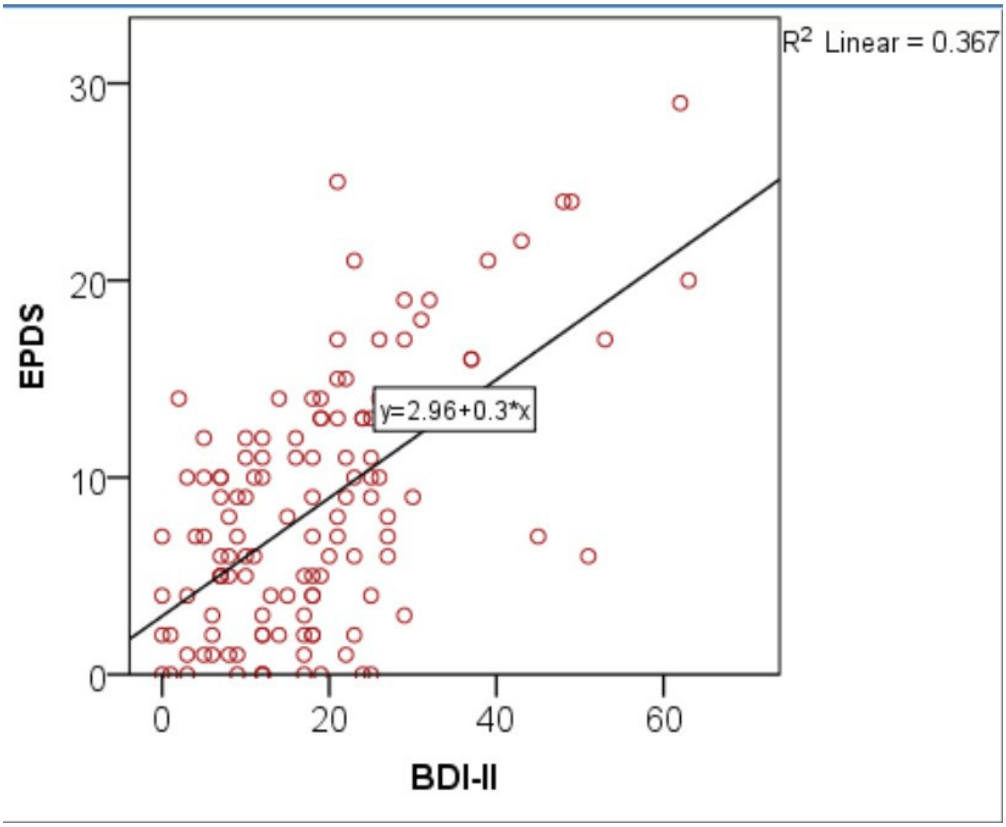

Figure (2): Correlation graph of the EPDS and BDI-II scales

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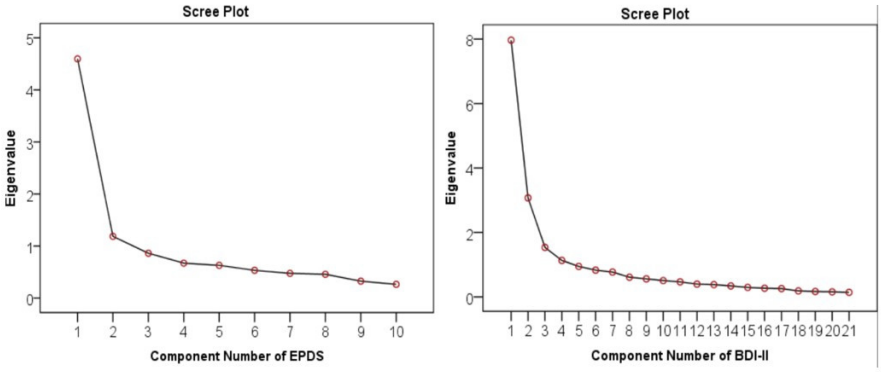

Figure (3): Scree plots of the EPDS and BDI-II scales