Antenatal screening timeline and cutoff scores of the Edinburgh Postnatal Depression Scale for predicting postpartum depressive symptoms in healthy women: a prospective cohort study

Akiko Tanuma-Takahashi1, Tomohiro Tanemoto1, Chie Nagata1,2, Ryo Yokomizo1, Akiko Konishi1, Kenji Takehara3, Tetsuo Ishikawa1,4, Nozomu Yanaihara1, Osamu Samura1* and Aikou Okamoto1

Abstract

Background: It is worthwhile to identify women at risk of developing postpartum depression during pregnancy. This study aimed to determine the optimal time and cutoff score for antenatal screening for prediction of postpartum depressive symptoms (PDS) using the Edinburgh Postnatal Depression Scale (EPDS) and to identify risk factors for PDS.

Methods: The target population was healthy pregnant women receiving antenatal care at a university hospital in Tokyo, Japan. During the first, second, and third trimesters, 3–4 days postpartum, and one month postpartum, they were asked to take the Japanese version of the EPDS questionnaire. The primary outcome of the study was PDS, defined as an EPDS score $\geq$ 9 at one month postpartum. The area under the receiver operating characteristics curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of EPDS scores at each antenatal screening time were calculated.

Results: From 139 pregnant women, 129 were successfully followed up throughout the study. The number of women with an EPDS score $\geq$ 9 during the first, second, and third trimesters, 3–4 days postpartum, and one month postpartum were 6/126 (4.8%), 9/124 (7.3%), 5/117 (4.3%), 17/123 (13.8%), and 15/123 (12.2%), respectively. Screening during the second trimester had the highest AUC to predict PDS (0.89) among antenatal screenings. The optimal EPDS cutoff score during the second trimester was 4/5 (sensitivity: 85.7%; specificity: 77.1%; PPV: 33.3%; NPV: 97.6%). An EPDS score $\geq$ 5 during the second trimester (adjusted odds ratio [aOR]: 15.9; 95% confidence interval [95%CI]: 3.2–78.1) and a family history of mental illness (aOR: 4.5; 95%CI: 1.2–17.5) were significantly associated with PDS.

Conclusions: Our study suggests that the EPDS score at the second trimester with the cutoff value of 4/5 may be adequate for initial screening for prediction of PDS. Women with an EPDS score $\geq$ 5 at the second trimester require more elaborate follow-up.
Background
Postpartum depression (PPD) is one of the major health problems in peripartum women and has been reported to affect attachment to the infant, malnutrition in the infant by maternal inadequacy for childcare, and their subsequent cognitive and physical development [1]. According to a systematic review and meta-analysis which covered studies from multiple countries, even among healthy mothers without a prior history of depression, the incidence rate of PPD was 12% [2]. In Japan, the incidence rate of PPD was reportedly 15.1% within the first month and 11.6% during 1–3 months postpartum [3].

Previous studies have shown a correlation of PPD with socioeconomic problems (e.g., economic status, educational level of women, poor marital relationship, stressful life events, and lack of social support) [4–7], as well as obstetric complications and newborn conditions [8, 9]. Mental illness during and/or before pregnancy, particularly previous depression, is also an independent antenatal predictor of PPD [4].

The Edinburgh Postnatal Depression Scale (EPDS) is the most widely used screening tool for PPD [10, 11]. The EPDS screening was reported to be effective for detecting both antepartum and postpartum depression [12–16]. Postpartum depressive symptoms (PDS) have been defined as having a high EPDS score [4, 17, 18]. Some studies have investigated the predictive validity of the antenatal EPDS for predicting PDS [17–19].

It is worthwhile to identify women at risk of developing PDS before delivery as this allows medical professionals to prepare for and provide necessary medical services for those women in a timely manner. However, the optimal time for screening during pregnancy and the optimal cutoff score of the EPDS for prediction of PDS have not yet been established. The primary aim of the present study was to determine the optimal time for antenatal EPDS screening and the EPDS cutoff score for prediction of PDS at one month postpartum.

Methods
Target population and study sample
The present study was conducted as a part of a prospective cohort study which aimed to examine biological stress markers during pregnancy and their association with PPD. The target population of the study was healthy pregnant women who were receiving antenatal care at the Jikei University Hospital, which is a tertiary hospital located in central Tokyo and has approximately 800–900 deliveries per year. Between July 2014 and June 2015, pregnant women at 7–9 weeks of gestation were invited to participate in this study. The inclusion criteria were as follows: 1) healthy women (defined as women without any disease [internal diseases, mental disorders, or gynecological diseases] at diagnosis of the current pregnancy), 2) with fetal heartbeat confirmed by ultrasound, 3) receiving antenatal care at our institution from the first trimester, 4) planning to give birth at our institution, and 5) being able to answer the questionnaire written in Japanese. The exclusion criteria were women with coexisting complications (e.g., diabetes mellitus, thyroid diseases, hypertension), women with multiple pregnancies, and women who planned to deliver at other hospitals. It was pre-planned that women who miscarried or aborted at the first trimester and women who moved to other hospitals would be excluded from the analysis.

Study schedule and measurements
As regular antenatal care, the following information was collected from all the participants at the first visit (maternal age, parity, mode of conception, complications in their previous pregnancies, education, past medical history, smoking, and alcohol consumption) and during the second and third trimesters (lifestyle, jobs, physical and mental condition, and expected support from their family). In addition to the regular antenatal care, participants were requested to respond to the questionnaires at 8–10 weeks of gestation (first trimester), at 24–26 weeks of gestation (second trimester), at 35–36 weeks of gestation (third trimester), at 3–4 days postpartum, and at one month postpartum. Each questionnaire included the Japanese version of EPDS and questions about sleeping hours, working hours, exercise habits, and support from their husbands/partners. There have been several reports which suggested that the EPDS during early postnatal days could be a useful screening instrument for early-onset PPD [5, 20]. Therefore, we included EPDS 3–4 days postpartum in the present study.

The EPDS is a 10-item self-reporting screening tool for PPD with each item scored on a 4-point scale ranging from 0 to 3, and total scores ranging from 0 to 30. The original English version of EPDS has acceptable identical consistency and reliability [10], and the Japanese version was confirmed to be equivalent to the original English version by Okano and others [21] with acceptable internal consistency and test–retest reliability [11].

Keywords: Edinburgh Postnatal Depression Scale, Postpartum depression, Postpartum depressive symptoms, Screening, Cutoff, Prediction
Statistical analysis
The primary outcome of the present study was PDS. In this study, we defined PDS as having a high EPDS (≥ 9) score at one month postpartum, which is considered to indicate a higher risk for PPD. The cutoff score of 8/9 at one month postpartum has been confirmed to be the most appropriate value for Japanese women (sensitivity 75%; specificity 93%) [21] and has been widely used to assess the risk of PPD in Japan [20, 22–26].

First, we investigated the trends in EPDS scores during pregnancy and postpartum. The EPDS screening during pregnancy was performed with the aim of predicting PDS, whereas the postpartum EPDS was performed with the aim of assessing PDS at that time. In order to determine the optimal screening time and cutoff score, we developed receiver operating characteristic (ROC) curves for each trimester by plotting the sensitivity against the “1 – specificity” of each cutoff value and calculated the area under the ROC curve (AUC). A value of 0.7–0.8 indicates a reasonable predictive accuracy, 0.8–0.9, a satisfactory accuracy, and a value of 0.9 or above is interpreted as excellent [27]. The difference among the AUCs obtained from EPDS scores at the first, second, and third trimester was tested using the Stata’s roccomp command [28]. The optimal cutoff score was determined using the Youden index, which is one of the statistical methods to obtain the best cutoff value for continuous variables [29].

Second, to investigate antenatal and perinatal risk factors for PDS, demographic, social, psychological, and physical factors were assessed in the preliminary univariate analysis. We tested whether each categorical variable was associated with PDS using Fisher’s exact test. We further conducted a multivariate logistic regression analysis. The main predictor in the multivariate logistic regression model was the variable created based on the results of the potential optimal screening time and cutoff score during pregnancy for prediction of PDS. In addition, variables with $P$ values less than 0.05 in the univariate analysis were considered to be potential risk factors and were included in the multivariate analysis. Adjusted odds ratios (aOR) and corresponding 95% confidence intervals (CIs) were calculated. The participants with missing data were excluded from each analysis.

All statistical analysis was performed using Stata 14.0 (StataCorp LP, College Station, Texas, USA). $P$ values less than 0.05 were considered to be statistically significant.

Results
During the recruitment period, a total of 139 pregnant women were enrolled in the study. Out of 139 participants, there were 10 participants who dropped out (one for twin pregnancy, four and two for first trimester miscarriage and abortion, and three for hospital transfer). As a result, data from 129 participants were included in the analysis (Fig. 1). Of these, 126, 124, 117, 123, and 123 participants completed the questionnaires in the first, second, and third trimesters, at 3–4 days postpartum, and one month postpartum, respectively (Fig. 1).

Characteristics of participants
The demographic characteristics of the participants are presented in Table 1A. The average maternal age was 32.9 years (range 26–41). All participants were Japanese and married. The most common family type was a nuclear family (95.2%). The majority of the participants graduated from a university or graduate school and were working full-time or part-time until they entered maternity leave (72.8% and 77.3%, respectively). Twenty-one participants (16.7%) had a family history of mental illness.

Table 1B presents delivery outcomes of the participants. The average gestational age at delivery was 38.5 weeks (range 31–41). The modes of delivery were natural vaginal delivery (90, 69.8%), vacuum or forceps delivery (14, 10.8%), planned cesarean section (13, 10.1%), and emergency cesarean section (12, 9.3%). Forty-six (35.7%) participants requested and received labor analgesia. Forty-nine (38.0%) had delivery complications.

Trends of EPDS scores
The trends of EPDS scores are shown in Fig. 2. The mean EPDS scores in the first, second, and third trimesters, at 3–4 days postpartum, and at one month postpartum were 3.51 (standard deviation [SD]: 2.67), 3.25 (SD: 3.10), 3.02 (SD: 3.06), 4.20 (SD: 4.46), and 3.89 (SD: 4.12), respectively. The mean EPDS score was highest at 3–4 days postpartum. On the other hand, the mean EPDS score was lowest in the third trimester.

ROC curves for the prediction of PDS
The ROC curve for each trimester was developed based on the data from participants who answered the questionnaire both at that trimester and one month postpartum (Fig. 3). The statistical test for the AUCs at the first, second, and third trimester revealed a statistically significant difference for predicting PDS among them ($P$ = 0.01). The AUC at the second trimester was higher among the AUCs during the antenatal period (0.89, 95% CI: 0.82–0.96). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for each of the possible cutoff scores of EPDS at the second trimester are shown in Table 2. A cutoff score of 3/4 had a quite high sensitivity (92.9%); however, the specificity was low (63.8%). On the other hand, cutoff scores of 5/6 and 6/7 had higher specificity (85.7%, 92.4%), whereas
the sensitivity was low (71.4%, 50.0%). The Youden index indicated that the cutoff score of 4/5 was reasonable for predicting PDS (sensitivity: 85.7%; specificity: 77.1%; PPV: 33.3%; NPV: 97.6%).

Antenatal and perinatal risk factors for PDS
The number of women with an EPDS score ≥ 9 at one month postpartum was 15/123 (12.2%). Antenatal and perinatal risk factors for predicting PDS are summarized in Table 3. Family history of mental illness was the only statistically significant risk factor for PDS found in the univariate analysis.

Multivariate regression models
The variable chosen as the main predictor was EPDS score ≥ 5 at the second trimester, which is a variable identified through the preceding analysis. Family history of mental illness, which had a P value of less than 0.05 in the univariate analysis, was included in the multivariate regression model. EPDS score ≥ 5 at the second trimester was a strong predictor of PDS. The aOR of developing PDS was 15.9 (95%CI: 3.2–78.1) for EPDS ≥ 5 at the second trimester by the multivariate logistic regression analysis. The aOR of developing PDS was 4.5 (95%CI: 1.2–17.5) for family history of mental illness.

Discussion
In this study, we found that the predictive ability of antenatal EPDS for prediction of PDS were significantly different depending on when the screening was performed. The AUC of EPDS scores at the second trimester was higher for prediction of PDS. Regarding the EPDS score at the second trimester, the cutoff score of 4/5 seemed to be reasonable considering the balance between sensitivity and specificity.
| **Variable** | **N (%)** |
|--------------|-----------|
| Maternal age, years |  |
| ≥ 40 | 6 (4.7) |
| 35–39 | 39 (30.2) |
| 26–34 | 84 (65.1) |
| Missing | 0 |
| Parity |  |
| Primiparous | 78 (60.5) |
| Multiparous | 51 (39.5) |
| Missing | 0 |
| Mode of conception |  |
| Natural or timed intercourse | 117 (90.7) |
| Artificial insemination | 5 (3.9) |
| In-vitro fertilization | 7 (5.4) |
| Missing | 0 |
| Education |  |
| University or graduate school | 83 (72.8) |
| Junior college or technical school | 21 (18.4) |
| High school | 4 (3.5) |
| Others | 6 (5.3) |
| Missing | 15 |
| Smoking before pregnancy |  |
| No | 116 (90.6) |
| Occasionally | 12 (9.4) |
| Missing | 1 |
| Alcohol before pregnancy |  |
| No | 25 (19.7) |
| Occasionally | 91 (71.7) |
| Almost every day | 11 (8.6) |
| Missing | 2 |
| Marital status | Yes | 129 (100) |
| Family type | Nuclear family | 120 (95.2) |
| Extended family | 6 (4.8) |
| Missing | 3 |
| Family history of mental illness | Yes | 21 (16.7) |
| Missing | 3 |
| Exercise at second trimester | Yes | 34 (26.6) |
| Missing | 1 |
| Working at second trimester | Full-time or part-time | 99 (77.3) |
| Homemaker | 29 (22.7) |
| Missing | 1 |

### B) Pregnancy and delivery outcomes

| **Variable** | **N (%)** |
|--------------|-----------|
| Gestational weeks at delivery |  |
| < 37 | 6 (4.7) |
| 37–41 | 123 (95.3) |
| Missing | 0 |
| Final mode of delivery |  |
| Natural vaginal | 90 (69.8) |
| Vacuum or forceps delivery | 14 (10.8) |
| Cesarean section, planned/emergency | 13/12 (10.1/9.3) |
| Missing | 0 |
| Epidural anesthesia | Yes | 46 (35.7) |
| Missing | 0 |
Screening timeline

Previous studies on the EPDS during the antepartum period generally aimed to validate the diagnostic accuracy of the EPDS for antepartum depression [14, 15, 30]. Other studies aimed to predict PDS using antenatal EPDS score; however, they obtained EPDS scores only once or twice during pregnancy at various screening times, or the EPDS was validated using only certain cutoff scores [4, 17, 19]. In our study, among the EPDS scores in the first, second, and third trimester, the EPDS score at the second trimester had the highest predictive ability for PDS. Generally, pregnant women have a more stable physical condition during the second trimester [31]; morning sickness has a non-negligible impact on women’s mental condition during the first trimester [32]; prenatal stress and physical discomfort (such as leg edema, labored breathing, and added weight) have a negative impact on health-related quality of life during the third trimester [33]. Thus, EPDS scores during the second trimester might reflect

Table 1 (continued)

| Complications during delivery | Weak pain or prolonged labor | 22 (17.0) |
|------------------------------|-----------------------------|-----------|
| Non-reassuring fetal status  | 7 (5.4)                     |           |
| Hypertensive disorders of pregnancy | 5 (3.9) |           |
| Atonic postpartum hemorrhage | 5 (3.9)                     |           |
| Fetal abnormality found postpartum | 2 (1.6) |           |
| Uterine infection            | 1 (0.8)                     |           |
| Others                       | 7 (5.4)                     |           |
| Missing                      | 0                            |           |

Feeding

| Feeding | Breast-feeding | 52 (42.3) |
|---------|----------------|-----------|
|         | Breast-feeding plus formula | 69 (56.1) |
|         | Formula | 2 (1.6) |
|         | Missing | 6 |

Fig. 2 Trends of EPDS scores during pregnancy and postpartum period. SD, standard deviation

| Number | 126 | 124 | 117 | 123 | 123 |
|--------|-----|-----|-----|-----|-----|
| Mean ± SD | 3.51 ± 2.67 | 3.25 ± 3.10 | 3.02 ± 3.06 | 4.20 ± 4.46 | 3.89 ± 4.12 |
| Range  | 0-11 | 0-14 | 0-19 | 0-21 | 0-19 |
| EPDS ≥ 9, N (%) | 6 (4.8%) | 9 (7.3%) | 5 (4.3%) | 17 (13.8%) | 15 (12.2%) |
women’s mental condition more clearly without being affected by their physical condition.

Cutoff score
There have been several studies which reported that the cutoff score of 4/5 could be used for the initial antenatal screening to detect women at risk of developing PDS, defined as postnatal EPDS score $\geq 10$ [18, 19]. Our study obtained results similar to these studies. In their studies, as well as ours, this low cutoff score enabled reaching a high NPV over 96% [18, 19], which means that women scoring < 5 on the antenatal EPDS can be reassured that it is very unlikely that they will develop PDS.

Risk factors
The antenatal EPDS is reported to perform better for prediction of PDS when combined with other predictors/risk factors, such as a prior history of major depression before pregnancy and low partner support [4, 19]. In our study, EPDS $\geq 5$ at the second trimester and family history of mental illness were identified as risk factors for PDS. There was no significant relationship between PDS and other risk factors such as socioeconomic problems, obstetric factors, and newborn conditions in our analysis unlike other studies. This may be because of the difference in background characteristics of the study populations as discussed in the Strengths and Limitations section below.

Strengths and limitations
The strength of our study is that EPDS scores were obtained at the first, second, and third trimesters of pregnancy and one month postpartum. This enabled us to investigate the optimal time for screening to identify women at risk of developing PDS.

Nonetheless, our study has some limitations. The participants of the present study were pregnant women...
| Variable (N) | Postpartum depressive symptoms\(^a\) | \(P\) value\(^b\) |
|-------------|--------------------------------------|----------------|
|             | Yes, \((N = 15), N (%)\)             | No, \((N = 108), N (%)\) |

[A] Antenatal risk factors

Maternal age, years
- < 35 (84) 13 (86.7) 66 (61.1) 0.082
- ≥ 35 (45) 2 (13.3) 42 (38.9)

Primiparous (78) 11 (73.3) 62 (57.4) 0.276

Mode of conception
- Natural conception/Timed intercourse (117) 15 (100) 96 (88.9) 0.358
- Artificial insemination/In-vitro fertilization (12) 0 (0) 12 (11.1)

Education
- University or graduate school (83) 10 (66.7) 70 (64.8) 0.616
- Junior college or technical school (21) 3 (20.0) 16 (14.8)
- High school (4) 1 (6.7) 3 (2.8)
- Others (6) 0 (0) 6 (5.6)

Smoking before pregnancy
- No (116) 12 (80.0) 98 (90.7) 0.167
- Yes (12) 3 (20.0) 9 (8.3)

Alcohol before pregnancy
- No (25) 3 (20.0) 21 (19.4) 0.245
- Occasionally (91) 9 (60.0) 77 (71.3)
- Almost every day (11) 3 (20.0) 8 (7.4)

Family type
- Nuclear family (120) 14 (93.3) 100 (92.6) 0.559
- Extended family (6) 1 (6.7) 5 (4.6)

Family history of mental illness (21) 7 (46.7) 13 (12.0) 0.004

Regular exercise at second trimester (34) 7 (46.7) 25 (23.2) 0.064

Working at second trimester (99) 13 (86.7) 84 (77.8) 0.736

Family support
- No (5) 0 (0) 4 (3.7) 1
- Yes (116) 13 (86.7) 98 (90.7)

[B] Perinatal risk factors

Preterm delivery, < 37 weeks (6) 0 (0) 4 (3.7) 1

Final mode of delivery
- Normal vaginal delivery (90) 15 (100.0) 72 (66.7) 0.102
- Vacuum or forceps delivery (14) 0 (0) 13 (12.0)
- Cesarean section (25) 0 (0) 23 (21.3)

Painless delivery (46) 7 (46.7) 37 (34.3) 0.395

Pregnancy and delivery complications, total (49) 2 (13.3) 43 (39.8) 0.050

- Weak pain or prolonged labor (22) 0 (0) 22 (20.3)
- Non-reassuring fetal status (7) 0 (0) 7 (6.5)
- Hypertensive disorders of pregnancy (5) 1 (6.7) 3 (2.8)
- Atonic postpartum hemorrhage (5) 1 (6.7) 3 (2.8)
- Fetal abnormality found postpartum (2) 0 (0) 1 (0.9)
- Uterine infection (1) 0 (0) 0 (0)
- Others (7) 0 (0) 7 (6.5)

\(^a\) Postpartum depressive symptoms were defined as an EPDS score ≥ 9 at one month postpartum

\(^b\) Analysis by Fisher's exact test
who were seen at a university hospital located in central Tokyo, who generally had good educational attainment, high socioeconomic status, and familial support. In addition, we only enrolled healthy women without co-existing diseases. This resulted in relatively low frequency of PDS and may jeopardize the generalizability of our study findings.

Conclusions

The EPDS score at the second trimester with the cutoff value of 4/5 may be adequate for initial screening for prediction of PDS. Women with an EPDS score ≥ 5 at the second trimester require more elaborate follow-up. Further research is needed to confirm this and better understand the risk factors for PPD in order to identify high-risk women during pregnancy.

Abbreviations

aOR: Adjusted Odds Ratio; AUC: Area Under the ROC Curve; CI: Confidence Interval; EPDS: Edinburgh Postnatal Depression Scale; NLR: Negative Likelihood Ratio; NPV: Negative Predictive Value; PDS: Postpartum Depression Symptoms; PLR: Positive Likelihood Ratio; PP: Postpartum Depression; PPV: Positive Predictive Value; ROC: Receiver Operating Characteristic; SD: Standard Deviation.

Acknowledgements

We would like to express our sincere thanks to all physicians, midwives, and nurses for recruiting participants in the Jikei University Hospital. We would like to express our gratitude to the medical English editor at the National Center for Child Health and Development for editing this manuscript.

Authors’ contributions

AT, TT, NY, and AO contributed to the study conception and design. Material preparation and data collection were performed by AT, TT, RY, AK, and OS. AT and TI analyzed data with advice from CN and KT. TT, CN, and AT wrote the first preparation and data collection were performed by AT, TT, RY, AK, and OS. AT wrote the first draft of the manuscript and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

The authors received no support from any organization for the submitted work.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available following the relevant guidelines in Japan, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The present study was conducted in accordance with the ethical standards of the relevant guidelines in the country and with the Helsinki Declaration. The study was approved by the Ethics Committee of the Jikei University School of Medicine (receipt number: 25–306 [7441]). Informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.
18. Meijer JL, Beijers C, van Pampus MG, Verbeek T, Stolk RP, Milgrom J, Bocking CL, Burger H. Predictive accuracy of Edinburgh postnatal depression scale assessment during pregnancy for the risk of developing postpartum depressive symptoms: a prospective cohort study. BJOG. 2014;121(13):1604–10.

19. Venkatesh KK, Kaimal AJ, Castro VM, Perlis RH. Improving discrimination in antepartum depression screening using the Edinburgh Postnatal Depression Scale. J Affect Disord. 2017;214:1–7.

20. Yamashita H, Yoshida K, Nakano H, Tashiro N. Postnatal depression in Japanese women: detecting the early onset of postnatal depression by closely monitoring the postpartum mood. J Affect Disord. 2000;58(2):145–54.

21. Okano T. Validation and reliability of a Japanese version of the EPDS. Arch Psychiatric Diagnosis Clin Eval. 1996;7:525–33.

22. Takehara K, Tachibana Y, Yoshida K, Mori R, Kakee N, Kubo T. Prevalence trends of pre- and postnatal depression in Japanese women: A population-based longitudinal study. J Affect Disord. 2018;225:389–94.

23. Nakano M, Sourander A, Luntamo T, Chudal R, Skokauskas N, Kaneko H. Early risk factors for postpartum depression. A longitudinal Japanese population-based study. J Affect Disord. 2020;269:148–53.

24. Maeda Y, Ogawa K, Morisaki N, Tachibana Y, Horikawa R, Sago H. Association between perinatal anemia and postpartum depression: A prospective cohort study of Japanese women. Int J Gynaecol Obstet. 2020;18(1):48–52.

25. Kubota C, Okada T, Aleksic B, Nakamura Y, Kunimoto S, Morikawa M, Shinoh T, Tamaji O, Okita H, Banno N, et al. Factor structure of the Japanese version of the Edinburgh Postnatal Depression Scale in the postpartum period. PloS ONE. 2014;9(8):e103941.

26. Ishikawa N, Goto S, Murase S, Kanai A, Masuda T, Aleksic B, Usui H, Ozaki N. Prospective study of maternal depressive symptomatology among Japanese women. J Psychosom Res. 2011;71(4):264–9.

27. Hanley JA, McNeil BJ. The meaning and use of the area under a receiver operating characteristic (ROC) curve. Radiol. 1982;143(1):29–36.

28. Cleves MA. From the help desk: Comparing areas under receiver operating characteristic curves from two or more probit or logit models. Stand Genomic Sci. 2002;2(3):301–13.

29. Youden WJ. Index for rating diagnostic tests. Cancer. 1950;3(1):32–5.

30. Usuda K, Nishi D, Okazaki E, Makino M, Sano Y. Optimal cut-off score of the Edinburgh Postnatal Depression Scale for major depressive episode during pregnancy in Japan. Psychiatry Clin Neurosci. 2017;71(12):836–42.

31. Raynor M, Marshall J. Myles textbook for midwives. UK: In.: Churchill Livingstone; 2014.

32. Lacsina A, Réy E, Ferreira E, Morin C, Berard A. Nausea and vomiting of pregnancy: what about quality of life? BJOG. 2008;115(12):1484–93.

33. Cunningham FG, Leveno KJ, Bloom SL, Dashe JS, Hoffman BL, Casey BM, Spong CY. Editors. In: Williams Obstetrics, 25e. edn. New York, NY: McGraw-Hill Education; 2018.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.