Predictive validity of the Japanese version of Postpartum Depression Predictors Inventory-Revised (PDPI-R) during pregnancy and the postpartum period

Med. J. Kagoshima Univ., September, 2016

Predictive validity of the Japanese version of Postpartum Depression Predictors Inventory-Revised (PDPI-R) during pregnancy and the postpartum period

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(Received 2016 Mar. 4; Revised June. 7; Accepted Jaly. 12)

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Abstract

Aim: To identify the risk factors for postpartum depression (PPD) during pregnancy and the early postpartum period is considered important for preventing the development of PPD. Postpartum Depression Predictors Inventory-Revised (PDPI-R, self-report questionnaires) was developed from Beck's updated meta-analysis and correlated with the development of PPD. The purpose of the present study was to investigate the predictive validity of the Japanese version of PDPI-R during pregnancy and one month after delivery.

Materials and methods: Pregnant Japanese women (n=192) participated in this study between December 2012 and February 2015 at the Department of Obstetrics and Gynecology, Kagoshima University Hospital and three practitioners in Kagoshima prefecture, all of which are located in the southern part of Japan. Subjects were 120 pregnant Japanese women who completed PDPI-R during 10-23 weeks of gestation and one month postpartum. All subjects delivered full-term healthy babies. PPD symptoms were measured by the Edinburgh Postnatal Depression Scale (EPDS) one month after delivery. The predictive validity of the Japanese version of PDPI-R was investigated. After identifying appropriate cut-off values by carrying out a receiver operating characteristic (ROC) curve, sensitivity, specificity, positive and negative predictive values, and the accuracy of PDPI-R were determined in both versions.

Results: Twelve (10%) out of 120 mothers met the PPD criteria with EPDS scores of 9 or higher. With a prenatal cut-off value of

7.0 after carrying out a ROC curve, the sensitivity and specificity of PDPI-R were 50.0% (6/12) and 87.0% (94/108), respectively. The positive and negative predictive values of PDPI-R were 30.0% (6/20) and 94.0% (94/100), respectively. The cut-off value of 7.0 was superior to 6.0 and 8.0. With a postpartum appropriate cut-off value of 8.0, sensitivity and specificity were 66.7% (8/12) and 88.0% (95/108), respectively. The positive and negative predictive values were 38.1% (8/21) and 96.0% (95/99), respectively. The cut-off value of 8.0 was superior to 7.0 and 9.0.

Conclusions: The Japanese version of PDPI-R is a useful instrument for predicting PPD in not only the postpartum period, but also the prenatal period. An appropriate cut-off value of PDPI-R may be 7.0 in the prenatal version and 8.0 in the postpartum version.

Key words: cut-off value, Edinburgh Postnatal Depression Scale, Japanese version, Postpartum Depression, Postpartum Depression Predictors Inventory-Revised, risk factor, sensitivity, specificity

Introduction

Postpartum depression (PPD) is a global phenomenon that has been reported in 10-15% of mothers in Western countries.[1), 2)] Suicides were previously shown to account for up to 20% of deaths during the postpartum period.[3)] PPD has been implicated in a number of these tragic cases. It has also been shown to affect a partner's mental health and child's socio-psychiatric development,[2, 4)] and has been associated with child neglect and abuse.[5, 6)] Although every pregnant woman is at risk of developing PPD, those with specific risk factors may be at a higher risk of developing PPD.[2, 7)] Thus, identifying the risk factors for PPD during pregnancy and the early postpartum period is considered important for preventing the development of PPD. Postpartum Depression Predictors Inventory-Revised (PDPI-R, self-report questionnaires) was developed from Beck's updated meta-analysis[8)] and correlated with the development of PPD.[9-11)] Compared with PDPI-R, the other instrument developed by Webster *et al*. does not assess factors including socio-economic status, marital status, child care stress, life stress, and prenatal depression, and is only used in the postpartum period, not during pregnancy.[12)] In previous screening instruments summarized by Ikeda *et al*.[13)] and Beck *et al*.[8, 14)] several items adopted in PDPI-R were absent. PDPI-R has the advantage of being the only prenatal screening scale.[8, 14)] In Japan, there have been no prenatal instruments to predict PPD.

Therefore, the purpose of the present study was to investigate the clinical usefulness of the Japanese version of PDPI-R and determine its predictive validity during the prenatal and postpartum periods.

Materials and methods

Fully informed written consent was obtained from each pregnant woman. This study was conducted in accordance with the Institutional Review Board (No.288) at Kagoshima University Hospital and the Helsinki Declaration, 2013. The Japanese version of PDPI-R was used after obtaining permission from Beck CT. PDPI-R was translated from English into Japanese by psychiatrists and a midwife, then translated back into English by a bilingual doctor. The Japanese version of PDPI-R was completed in consensus.

Pregnant Japanese women (n=203) participated in this study between December 2012 and February 2015 at the Department of Obstetrics and Gynecology, Kagoshima University Hospital and three practitioners in Kagoshima prefecture, all of which are located in the southern part of Japan. Exclusion criteria included women who refused entry to this study (n=11), those who had a past history of medically-treated psychiatric disorders including (postpartum) depression (n=4), those who could not understand Japanese, (n=1) and those who dropped out (n=67). Drop out cases included premature delivery (n=3), intrauterine fetal death (n=1), and incomplete PDPI-R (n=63). Incomplete PDPI-R cases were almost all in postpartum women due to being busy with childcare. Thus, 120 women were enrolled in this study. All subjects completed PDPI-R (self-report questionnaires) during 10-23 weeks of gestation and one month postpartum. Gestational age at the first survey was 17.3 weeks (SD ＝ 4.2).

All subjects delivered full-term healthy babies. Baseline characteristics included age, gestational age, marital status, employment status, socio-economic status, and parity. PDPI-R during 10-23 weeks of gestation included 10 items: 1) marital status, 2) socio-economic status, 3) self-esteem, 4) prenatal depression, 5) prenatal anxiety,

6) unplanned/unwanted pregnancy, 7) history of previous depression, 8) social support, 9) marital dissatisfaction, and 10) life stress.

Total scores on the prenatal version of PDPI-R ranged from 0 to 32. Three additional items were included in the postpartum PDPI-R examination one month after delivery: 11) child care stress, 12) infant temperament, and 13) maternity blues. Total scores on the postpartum version ranged from 0 to 39. PPD symptoms were measured by the Edinburgh Postnatal Depression Scale (EPDS) [15] one month after delivery. Women with EPDS scores of 9 or higher were suspected of PPD in the Japanese criteria.[16-18]

Statistical analysis

Intra- and inter-group comparisons were performed by the McNemar test, Wilcoxon rank-sum test, and Mann-Whitney *U* test, as appropriate. Relationships between variables were assessed by the Spearman rank correlation test. A univariate logistic regression analysis was used to determine the odds ratio of 13 items in the development of PPD. The strength of the odds ratio was explained as a 95% confidence interval (CI). In this analysis, the independent variable was the presence or absence of PPD (non-PPD), while the dependent variables were the 13 items tested. The presence or absence of PPD was a nominal variable, and the presence of PPD was registered as 1, while its absence was registered as 0. After identifying appropriate cut-off values by carrying out a receiver operating characteristic (ROC) curve, sensitivity, specificity, positive and negative predictive values, and the accuracy of PDPI-R were determined in both versions. $P<0.05$ was considered significant. Statistical analyses were performed using SPSS, version 22 (IBM, Armonk, NY, USA).

Results

Twelve (10.0%) out of 120 mothers met the PPD criteria with EPDS scores of 9 or higher. Table 1 shows the baseline characteristics of the enrolled subjects (n=120). The percentages of primiparous and married women were 51.7%, and 89.2%, respectively. Only 2.5% of the women were single. A quarter of the women (24.2%) had a low socio-economic status. No significant differences were observed in the distribution of marital status, employment status, socio-economic status and parity between the two groups. Mean age was 30.1 years (SD=4.6).

Table 2 shows changes in risk factor scorings of PDPI-R during pregnancy and the postpartum period in all subjects. The low self-esteem variable was significantly different between the pregnancy and the postpartum periods ($p<0.05$). No significant differences were observed in the other 9 variables between the two time points. Table 3 shows the

Table 1 Baseline characteristics of enrolled subjects (n=120)

		n (%)	PPD	non-PPD	*p* (Fisher's exact test)
Marital status	Single	3 (2.5)	1	2	0.474
	Married	107 (89.2)	10	97	
	Separated	1 (0.8)	0	1	
	Partnered	9 (7.5)	1	8	
Employment status	Housewife	48 (40.0)	3	45	0.593
	Employed	53 (44.1)	7	46	
	Part-time	17 (14.2)	2	15	
	Self-employed	2 (1.7)	0	2	
Socio-economic status	Low	29 (24.2)	4	25	0.304
	Medium	90 (75.0)	8	82	
	High	1 (0.8)	0	1	
Parity	0	62 (51.7)	7	55	0.450
	1	45 (37.5)	3	42	
	2	11 (9.2)	1	10	
	3	2 (1.7)	1	1	

Table 2 Changes in risk factor scorings of PDPI-R during pregnancy and the postpartum period (n=120)

	Range		Median (range) † / Number (%)		*p* (McNemar Wilcoxon)
			During pregnancy	One month postpartum	
Prenatal variables					
F1 Being single	0-1		3 (2.5)	1 (0.8)	0.625
F2 Low socio-economic status	0-1		29 (24.2)	25 (20.8)	0.523
F3 Low self-esteem ǂ	0-3	1	23 (19.2)	27 (22.5)	0.018*
		2	24 (20.0)	15 (12.5)	
		3	7 (5.8)	5 (4.2)	
F4 Perinatal depression	0-1		12 (10.0)	19 (15.8)	0.167
F5 Prenatal anxiety	0-1		74 (61.7)	71 (59.2)	0.749
F6 Pregnancy intendedness §	0-2	1	41 (34.2)	41 (34.2)	0.987
		2	2 (1.7)	2 (1.7)	
F7 Prior depression	0-1		10 (8.3)	11 (9.2)	0.705
F8 Lack of social support //	0-12		0 (0-8) †	0 (0-7) †	0.228
F9 Marital dissatisfaction ¶	0-3	1	18 (15.0)	18 (15.0)	0.859
		2	2 (1.7)	5 (4.2)	
		3	2 (1.7)		
F10 Life stress **	0-7		0 (0-3) †	0 (0-4) †	0.800
Postpartum variables					
F11 Child care stress ††	0-3	1		28 (23.3)	
		2		8 (6.7)	
F12 Infant temperament §§	0-3	1		52 (43.3)	
		2		22 (18.3)	
		3		3 (2.5)	
F13 Maternity blues	0-1			51 (42.5)	

* $p < 0.05$

ǂ Do you feel good about yourself? Do you feel worthwhile? Do you have good qualities?

§ Was the pregnancy planned? Was the pregnancy unwanted?

// Do you believe that you receive adequate emotional support from your (partner/family/friends)?
Do you believe that you can confide in your (partner/family/friends)?
Do you believe that you can rely on your (partner/family/friends)?
Do you believe that you receive adequate instrumental support from your (partner/family/friends)?

¶ Are you satisfied with your marriage or living arrangement?
Are you currently experiencing any marital relationship problems?
Are things going well between you and your partner?

** Are you currently experiencing any stressful events in your life such as (financial problems/marital problems/death in family/unemployment/serious illness in family/moving/job change)?

†† Is the infant experiencing any health problems?
Are you having problems feeding the baby?
Are you having problems with the baby sleeping?

§§ Would you consider the baby irritable?
Does the baby cry a lot?
Is your baby difficult to console or soothe?

Table 3 Distribution of Postpartum Depression cases at two time points during pregnancy

	Gestational age 10-16 weeks n (%)	Gestational age 17-23 weeks n (%)	*P* (Chi-square test)
PPD	4 (7.7)	8 (11.8)	0.461
non-PPD	48 (92.3)	60 (88.2)	

Table 4 Total PDPI-R scores in PPD and non-PPD women at two time points

	PPD (n=12)			non-PPD (n=108)			*p*
	med.	min.	max.	med.	min.	max.	(Mann-Whitney *U* test)
Prenatal version	6.50	2	16	3.00	0	13	< 0.05
Postpartum version	8.00	3	17	4.00	0	17	< 0.001

Table 5 Odds ratio of PDPI-R variables in the development of PPD

	During pregnancy		One month postpartum	
	Odds Ratio	95% Cl	Odds Ratio	95% Cl
Prenatal version				
F1 Being single	4.82	0.40 - 57.50	NA	NA
F2 Low socio-economic status	1.58	0.44 - 5.66	2.07	0.57 - 7.54
F3 Low self-esteem	1.67	0.95 - 2.95	2.92	1.56 - 5.45†
F4 Prenatal depression	1.96	0.38 - 10.22	5.22	1.44 - 18.88*
F5 Prenatal anxiety	3.18	0.66 - 15.24	3.85	0.81 - 18.43
F6 Pregnancy intendedness	0.84	0.25 - 2.76	1.62	0.55 - 4.76
F7 Prior depression	1.14	0.13 - 9.95	1.00	0.12 - 8.65
F8 Lack of social support	1.29	0.99 - 1.69	1.43	1.08 - 1.89*
F9 Marital dissatisfaction	2.26	1.04 - 4.90*	2.30	0.93 - 5.67
F10 Life stress	1.50	0.70 - 3.19	1.58	0.88 - 2.83
Postpartum version				
F11 Child care stress			2.10	0.91 - 4.84
F12 Infant temperament			1.87	0.91 - 3.86
F13 Maternity blues			4.71	1.21 - 18.42*

* $p < 0.05$
† $p < 0.01$
CI = confidence interval
NA = not available

Table 6 Spearman rank correlation test between variables in the prenatal version (n=120)

	Total score	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Total score	1										
F3 Self-esteem	0.567†	ns	ns	1							
F4 Prenatal depression	0.128	—	—	ns	1						
F5 Prenatal anxiety	0.279†	—	—	ns	—	1					
F6 Unplanned/unwanted pregnancy	0.294†	0.208*	ns	ns	ns	ns	1				
F7 History of previous depression	-0.047	—	—	ns	—	—	ns	1			
F8 Social support	0.717†	ns	ns	0.228*	ns	ns	ns	ns	1		
F9 Marital dissatisfaction	0.432†	0.190*	ns	0.201*	0.188*	ns	ns	ns	0.307†	1	
F10 Life stress	0.391†	ns	0.191*	ns	ns	ns	ns	ns	0.250†	0.271†	1

* $p < 0.05$
† $p < 0.01$
ns = not significant

distribution of the postpartum depression casas at two time points during pregnacy. The distribution of PPD was not significantly different between the two time points. Table 4 shows total PDPI-R scores in PPD (n=12) and non-PPD women (n=108) at the two time points. In the prenatal PDPI-R version, median scores were higher in PPD than in non-PPD women. In the postpartum version, median scores were also higher in non-PPD women. Median scores were higher in the postpartum version than in the prenatal version in both groups. The spearman rank correlation test between total PDPI-R scores at two time points. The prenatal version was positively correlated with the postpartum version (r=0.394, $p<0.001$).

Table 5 shows the odds ratio of PDPI-R items in the development of PPD from a univariate logistic regression analysis. In the prenatal version, marital dissatisfaction was identified as a significant predictor of PPD (Odds ratio; 2.26, 95% CI; 1.04-4.90, $p<0.05$). In the postpartum version, low self-esteem (odds ratio; 2.92, 95% CI; 1.56-5.45, $p<0.01$), prenatal depression (5.22, 1.44-18.88, $p<0.05$), lack of social support (1.43, 1.08-1.89, $p<0.05$), and maternity blues (4.71; 1.21-18.42, $p<0.05$) showed significant high odds ratios. Tables 6 and 7 show the results of the Spearman rank correlation test between variables in the prenatal and postpartum versions. In the prenatal version, low self-esteem positively correlated with the lack of social support (r=0.228, $p<0.05$), marital dissatisfaction (0.201, $p<0.05$), and total scores (0.567, $p<0.01$) (Table 6). In the postpartum version, prenatal depression was positively correlated with marital dissatisfaction (0.251, $p<0.01$), and total PDPI-R scores (0.309, $p<0.01$) (Table 7). Maternity blues positively correlated with infant temperament (0.204, $p<0.05$) and total scores (0.289, $p<0.01$).

After carrying out a ROC curve, appropriate cut-off values were identified as 7.0 in the prenatal version and 8.0 in the postpartum version. Table 8 shows the sensitivity, specificity, positive and negative predictive values, and accuracy in appropriate and nearly appropriate cut-off values in the two versions. With a prenatal cut-off value of 7.0, sensitivity and specificity were 50.0% (6/12) and 87.0% (94/108), respectively. The prenatal cut-off value of 7.0 was superior to 6.0 and 8.0. The positive and negative predictive values of PDPI-R during pregnancy were 30.0% (6/20) and 94.0% (94/100) at a cut-off value of 7.0, respectively. The positive predictive cut-off value of 7.0 was superior to 6.0 and 8.0. In the postpartum version, sensitivity and specificity were 66.7% (8/12) and 88.8% (95/108), respectively, with a cut-off value of 8.0. The postpartum cut-off value of 8.0 was superior to 7.0 and 9.0. The positive and negative predictive values were 38.1% (8/21) and 96.0% (95/99), respectively. The positive predictive cut-off value of 8.0 was superior to 7.0 and 9.0. In addition the postpartum version was superior to the prenatal version (38.1% and 30.0%, respectively.).

Discussion

The prevalence of PPD is suggested to vary with the mother's background including age, parity, educational level, socio-economic status, marital status, social support, culture, geography, and race.[7] It may also differ based on the number of women with a past history of depression and the cut-off value of EPDS.[13, 19-23] The cut-off value of EPDS is generally higher in Western countries[19, 21-23] than in Japan.[16-18] However, accumulating evidence has indicated that the prevalence of PPD is similar.[14, 16, 17, 24-26] In the present study, the prevalence of PPD determined based on EPDS scores of 9 or higher was 10.0%. This prevalence rate was not different from previous findings.[14, 17, 24, 25, 27, 28]

In the prenatal PDPI-R version, a history of depression, current depression/anxiety, and low level of partner support have been associated with the occurrence of PPD.[7] Current depression/anxiety may be amenable to change and, thus may be targeted for medical intervention.[7] In the present study, among the 10 variables tested, only marital dissatisfaction was identified as a significant predictor of PPD. This result was inconsistent with the findings of Milgrom *et al*.[7] Possible explanations for this discrepancy include differences in the number of enrolled subjects, subject backgrounds, screening instruments, and culture. In the present study, marital dissatisfaction was associated with prenatal depression and the lack of social support in a univariate regression analysis. Therefore, our results did not always disagree with those by Milgrom *et al*.

The postpartum period is characterized by increased susceptibility to different mood disorders of varying severity.[29] This is also supported by the results of the present study, which showed that the total PDPI-R score increased in the postpartum period in not only PPD, but also non-PPD women. Maternity blues has been reported in approximately 40-70% of postpartum women within a few days of delivery in Western countries.[30, 31] Although the etiology of maternity blues remains unclear, maternity blues and PPD are common complications in postpartum women. Previous studies have investigated the relationship between the severity of

Table 7 Spearman rank correlation test between variables in the postpartum version (n=120)

	Total score	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
Total score	1													
F3 Self-esteem	0.409†	ns	ns	1										
F4 Prenatal depression	0.309†	—	—	ns	1									
F5 Prenatal anxiety	0.193*	—	—	0.265†	—	1								
F6 Unplanned/unwanted pregnancy	0.389†	ns	0.277†	ns	ns	ns	1							
F7 History of previous depression	0.145	—	—	ns	—	—	ns	1						
F8 Social support	0.513†	ns	ns	0.265†	ns	ns	ns	ns	1					
F9 Marital dissatisfaction	0.270†	ns	ns	ns	0.251†	ns	ns	ns	0.251†	1				
F10 Life stress	0.466†	ns	0.330†	0.188*	ns	ns	ns	ns	0.200*	ns	1			
F11 Child care stress	0.405†	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	1		
F12 Infant temperament	0.458†	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.257†	1	
F13 Maternity blues	0.289†	—	—	ns	—	—	ns	—	ns	ns	ns	ns	0.204*	1

* $p < 0.05$
† $p < 0.01$
ns = not significant

Table 8 Sensitivity, specificity, positive and negative predictive values, accuracy of appropriate and nearly appropriate cut-off values in the two versions

Cut-off value	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
Prenatal version of PDPI-R					
5.0	66.6% (8/12)	72.2% (78/108)	21.1% (8/38)	96.3% (78/81)	70.8%
6.0	58.3% (7/12)	81.5% (88/108)	25.9% (7/27)	94.6% (88/93)	79.1%
7.0	**50.0% (6/12)**	**87.0% (94/108)**	**30.0% (6/20)**	**94.0% (94/100)**	**83.3%**
8.0	33.3% (4/12)	89.8% (97/108)	26.7% (4/15)	92.4% (97/105)	84.1%
9.0	33.3% (4/12)	92.6% (100/108)	33.3% (4/12)	92.6% (100/108)	86.7%
10.0	8.3% (1/12)	95.4% (103/108)	16.7% (1/6)	90.4% (103/114)	86.7%
11.0	8.3% (1/12)	97.2% (105/108)	25.0% (1/4)	90.5% (105/116)	88.3%
Postpartum version of PDPI-R					
6.0	83.3% (10/12)	70.4% (76/108)	23.8% (10/42)	97.4% (76/78)	71.6%
7.0	75.0% (9/12)	80.6% (87/108)	30.0% (9/30)	96.7% (87/90)	80.0%
8.0	**66.7% (8/12)**	**88.0% (95/108)**	**38.1% (8/21)**	**96.0% (95/99)**	**85.8%**
9.0	41.7% (5/12)	88.9% (96/108)	29.4% (5/17)	93.2% (96/103)	84.2%
10.0	33.3% (4/12)	91.7% (99/108)	30.8% (4/13)	92.5% (99/107)	85.8%
11.0	33.3% (4/12)	93.5% (101/108)	36.4% (4/11)	92.7% (101/109)	87.5%
12.0	33.3% (4/12)	95.4% (103/108)	44.4% (4/9)	92.8% (103/111)	89.2%

maternity blues and the risk of PPD.[10, 11, 17, 20, 27, 30-34] In the postpartum version, we found that maternity blues was a significant predictor of PPD (odds ratio=4.71) as well as prenatal depression (5.22), low self-esteem (2.92), and the lack of social support (1.43). Our results were consistent with previous findings.[8, 10, 11, 17, 20, 24, 27, 31-34] Watanabe *et al*. reported that maternity blues was a strong predictor of PPD, and the higher the blues score, the higher the risk of PPD (odds ratio=9.57).[27] Youn *et al*. also demonstrated that maternity blues, as well as prenatal depression and the lack of social support, were associated with the development of PPD in Korean mothers.[20] Beck found that maternity blues was one of the important predictors of PPD.[10] Thus, we must pay particular attention to mothers with maternity blues in order to prevent the development of PPD.[14, 17] Similar to maternity blues, prenatal depression, low self-esteem, and the lack of social support were identified as significant predictors of PPD. These results agree with previous findings.[13, 19] Thus, we must also pay close attention to women lacking social support and/or with a past history of prior or prenatal depression.

With an appropriate prenatal cut-off value of 7.0, sensitivity and specificity were 50.0% and 87.0%, respectively. These results are consistent with previous findings reported by Ikeda *et al*.[13], but were inferior to those by Oppo *et al*.[19] However, in the study by Oppo *et al*. PDPI-R was performed at 8 months of gestation.[19] The different timing of PDPI-R may have led to different cut-off values. With the postpartum cut-off value of 8.0, sensitivity and specificity were 66.7% and 88.0%, respectively. Sensitivity was inferior, while specificity was superior to those reported by Ikeda *et al*.[13] and Oppo *et al*.[19] The reasons for these discrepancies currently remain unclear. In the present study, the sensitivity and positive predictive value of PDPI-R were higher in the postpartum version than in the prenatal version, and this was attributed to the timing of postpartum PDPI-R being near to the onset of PPD. The results of the present study demonstrated that PDPI-R was characterized by higher specificity and a higher negative predictive value. However, a careful follow-up and appropriate counselling are necessary for reducing the risk of PPD in women with more than an appropriate cut-off value. In addition, there was a positive correlation in the total score of both prenatal and postpartum versions. Thus, the Japanese version of PDPI-R is a useful instrument for predicting PPD in not only the postpartum, but also prenatal period. This is important for supporting women at high risk for PPD during pregnancy.

We identified appropriate cut-off values of 7.0 in the prenatal and 8.0 in the postnatal version of PDPI-R. The higher postpartum cut-off value was attributed to it having more variables. However, disagreements persist with regard to the cut-off value of PDPI-R.[13, 14, 19, 35] Possible explanations for this discrepancy may include the following. Ikeda *et al*. reported that an appropriate prenatal cut-off value was 6.0 and postpartum cut-off value was 8.0 in the Japanese version.[13] Their postpartum cut-off value was the same ours. Possible reasons for the slight difference in the prenatal cut-off value may include differences in the number of enrolled subjects, percentage of single mothers, low socio-economic status, and those with a past history of depression among the enrolled subjects. In the present study, subjects with medically-treated psychiatric disorders were excluded, but were included in the study by Ikeda *et al*.[13] In the study by Ikeda *et al*., all subjects were urban women without a low socio-economic status and with a high education level, which was significantly different from our study on primi-, multiparous women, in which a quarter of women had a low socio-economic status. Furthermore, we performed a prenatal examination within 6 months of pregnancy, while Ikeda *et al*. conducted theirs at 8 months of pregnancy.[13] These differences may have led to slight differences in prenatal cut-off values. Beck *et al*. previously reported a postpartum cut-off value of 10.5.[14] However, PDPI-R was examined at two and six months postpartum. PPD occurs four weeks after delivery, and its risk increases within the first 3 months of delivery.[36] Thus, the cut-off value of PDPI-R may become high at two months postpartum. Additionally, there were 10 to 13 variables in PDPI-R; however, the distribution of each variable may differ with the population examined. In the present study, marital dissatisfaction (odds ratio = 2.26) in the prenatal version, and maternity blues (4.71) and prenatal depression (5.22) in the postpartum version were significant predictors of PPD. Odds ratios of maternity blues and prenatal depression were high, despite the lower scale and scoring. When some variables with a low scale and scoring, but a high odds ratio, such as marital dissatisfaction, maternity blues, prenatal depression, and prior depression, are one-sided and strong (i.e., high odds ratio) predictors of PPD, the cut-off value may become low. Oppo *et al*. previously reported low cut-off values (4.0 in the prenatal and 6.0 in the postpartum version), with high odds ratios for maternity blues (odds ratio=4.9) and prenatal depression (9.97),[19] and these two variables were given a low scale (0 or 1). In the study by Ikeda *et al*., the percentages of prenatal depression and prior depression in the prenatal version were two-fold higer than our values.[13] Thus, the cut-off value of PDPI-R may differ with the distribution of variables. Furthermore, a previous study reported that the incidence of suicide attempt due to depression differed between the climates in the northern and southern parts of Japan.[37] Regional variations may exist in the prevalence of PPD even in the same country.[38] Thus, cut-off values may be slightly different among the urban and rural, as well as southern and northern parts of a country, as shown by the present study and by Ikeda *et al*.[13] The accuracy of EPDS may also be involved in the difference observed in PDPI-R cut-off values. An extreme dominance in false positive cases of EPDS in the studied population may be associated with lower PDPI-R cut-off values, while extreme dominance in false negative cases of EPDS may be associated with higher PDPI-R cut-off values. In addition, differences in the manner by which the EPDS examination was conducted, interviews or self-report questionnaires, may produce different PDPI-R cut-off values. Moreover, differences in the EPDS cut-off values may influence PDPI-R cut-off values. Low cut-off values for EPDS may be associated with low cut-off values for PDPI-R.

However, this possibility may be denied by the relatively low EPDS cut-off value (9.0) with a high cut-off value for PDPI-R in our study and Ikeda's study,[13] and the relatively high EPDS cut-off value (13.0) with a low cut-off value for PDPI-R in the study by Oppo *et al*.[19]

Other than a prenatal examination of PDPI-R, the ideal timing of the postpartum PDPI-R examination currently remains unclear. Maternity blues is a strong predictor of the development of PPD,[10, 17, 20, 27, 30-34] occurs within the first few days of delivery, and continues for one week. Therefore, one to two weeks after delivery may be the ideal timing for the early identification of the risk factors for PPD using PDPI-R. However, mothers and babies are at home during this period. The first month after delivery is the most critical timing for mothers with psychiatric symptoms including PPD.[39] In addition, in Japan, mothers and babies routinely visit hospitals for health check-ups one month after delivery. Thus, one month after delivery may be a practical time point to perform PDPI-R.

Based on these results, we concluded that the Japanese version of PDPI-R is a useful instrument for predicting PPD. The advantage of PDPI-R includes its ability to predict PPD not only in the postpartum period, but also in the prenatal period. In Kagoshima, which located in the southern part of Japan, an appropriate cut-off value of PDPI-R may be 7.0 in the prenatal version and 8.0 in the postnatal version, in the absence of a past history of medically-treated (postpartum) depression and psychosis. Appropriate cut-off values of PDPI-R may differ based on the regions examined, therefore, cut-off values need to be determined in accordance with regions, even in the same country. Our study had some limitations including the small number of enrolled subjects in a restricted, rural, and southern part of Japan. We also did not conduct PDPI-R in pregnant women living in the northern part of Japan. Thus, a more extensive study is necessary and warranted in order to determine whether cut-off values differ based on the region examined in Japan.

Disclosure of potential conflict of interests

All authors declare that they have no financial relationships with biotechnology manufacturers, pharmaceutical companies, or other commercial entities with an interest in the subject matter or materials discussed in this manuscript.

Acknowledgments

This study was supported by JSPS KAKENHI Grant Number 25463480. We appreciate the cooperation of Tom Ijyuin, MD, Mitsuhiro Nakae, MD, Shinichi Yamamoto, MD in generously collecting data for our study. We also thank to all women who participated in this study.

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Postpartum Depression Predictors Inventory-Revised (PDPI-R) 日本語版による産後うつ病発生の予測に関する検討

若松美貴代[1*)]、中村雅之[2)]、春日井基文[2)]、肝付洋[2)]、沖利通[3)]、折田有史[3)]、戸上真一[3)]、小林裕明[3)]、佐野輝[2)]、堂地勉[3)]

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目的：産後うつ病（Postpartum Depression：PPD）は本人の自殺，パートナーや子供のメンタルヘルス，認知機能，社会的・情緒的発達，虐待とも関連する。PPD 関連の自殺者は産科出血による死亡数より多いとする報告もある。故に妊娠中，産褥早期にリスク因子を見つけてケアすることが重要である。今回米国で開発された Postpartum Depression Predictors Inventory-Revised (PDPI-R) を産褥期だけでなく妊娠中にも検査し，PPD を妊娠期に予測出来るか否かを検討した。
方法：2012 年 12 月から 2015 年 2 月までに，鹿児島県内産婦人科に通院中，または入院中の妊婦で精神科疾患の既往がなく研究同意が得られた者を対象とした。PDPI-R は日本語に翻訳した後に逆翻訳し，原尺度と比較検討し日本語，英語について整合性の得られたもので日本語翻訳を完成させた。妊娠 10-23 週に PDPI-R (自己評価票) 産前版（social support の欠如，life stress などのリスク因子 10 項目，0-32 点満点）と産褥 1 ヶ月に PDPI-R 産後版（産前版 10 項目 + 育児ストレス，子どもの気質，maternity blues のリスク因子 3 項目，合計 13 項目，0-39 点満点）を実施し産前と産後の 2 時点で完全に解答し終えた 120 人を対象とした。PPD のスクリーニングはエジンバラ産後うつ病自己評価票 9 点以上とした。Receiver operating characteristic curve を用いて，PDPI-R の妥当な cut-off 値を決め，PPD のハイリスク群が予測出来るか否かを検討した。
結果：1）PPD は 12 人（10%）であった。2）妊娠中 PDPI-R の cut-off 値を 7.0 に決定したとき，PPD 予測の感度は 50.0%（6/12），特異度は 87.0%（94/108）であり，cut-off 値 6.0，8.0 のそれらに比較して優れていた。陽性，陰性的中率も 7.0 が優れていた。3）産褥期 PDPI-R の cut-off 値を 8.0 にしたとき，感度は 66.7%（8/12），特異度 88.0%（95/108）であり，cut-off 値 7.0 と 9.0 のそれらに比較して優れていた。陽性，陰性的中率も 8.0 が優れていた。
結論：PDPI-R 日本語版は産褥期だけでなく妊娠中から産後うつ病のハイリスク群を予測できる有用な方法である。本研究での PDPI-R の cut-off 値は妊娠中で 7.0，産褥 1 ヶ月で 8.0 が妥当であると思われた。我々の設定した cut-off 値は本邦の他の報告と類似するが，欧米の報告より cut-off 値が高かった。