

CLINICAL ARTICLE

Obstetrics

Development of Social Life Impact for Mother (SLIM) scale at first trimester to identify mothers who need social support postpartum: a hospital-based prospective study in Japan

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Abstract

Objective: To develop and validate the Social Life Impact for Mother (SLIM) scale to identify mothers in Japan who need social support postpartum.

Methods: Hospital-based prospective study was implemented nationwide in Japan. A total of 7462 pregnant women completed the SLIM scale in their first trimester, and postpartum social problems (postpartum depression and bonding disorders) were assessed at 1 month after delivery ($N = 5768$, follow-up rate 77.3%). Multivariate logistic regression was applied to investigate the association between SLIM scale and postpartum social problems.

Results: The SLIM scale is made up of nine risk factors for postpartum social problems, including relationship problems, lower financial status, and lack of social support. The SLIM scale predicted postpartum social problems with moderate accuracy (area under the curve 0.63, 95% confidence interval 0.60–0.65). Further stratification by local clinic and tertiary hospital did not affect the estimates.

Conclusion: The SLIM scale at prenatal check-up may be useful for obstetricians to detect mothers with postpartum social problems. Further intervention studies using the SLIM score are warranted.

KEYWORDS

bonding disorders, child abuse, postpartum depression, pregnant women

1 | INTRODUCTION

Postpartum social problems, such as postpartum depression (PPD) and bonding disorders, are important risk factors for child maltreatment, a global social issue that needs to be addressed.¹ The prevalence of PPD can be as high as 15% in high-income countries,² although the prevalence rates vary among studies. It is also well-known that PPD has negative effects on child development.³ In

addition to child maltreatment, PPD is also related to maternal suicide during the postpartum period.⁴ Another important risk factor for child maltreatment to note is mother-infant bonding disorder, according to Bowlby's attachment theory.⁵ Maternal poor attachment behaviors, i.e. bonding disorders, have been associated with child abuse and infanticide.⁶

As mothers who have PPD and bonding disorders are considered as having a social problem, this can be modified by social support.

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Previous studies reported that postpartum women with low social support had significantly higher depression scores than those with high social support.⁷ Similarly, bonding failure was associated with low social support.⁸ A previous study showed that the number of individuals from whom mothers can receive social support and mothers' satisfaction level with social support received during pregnancy have a great influence on bonding failure and depression in the postpartum period.⁸ There is a need to develop a scale to detect such social problems in mothers at an early stage, such as the first trimester, so as to provide the necessary social support for these mothers.

Previous studies have shown several risk factors for postpartum social problems, including young maternal age,⁹ unintended pregnancy,¹⁰ maternal mental disorders,¹¹ maternal developmental disorders,¹² low socioeconomic status,^{9,13} lack of existing social support,⁹ history of childhood abuse,¹⁴ existence of intimate partner violence,¹⁵ single motherhood,⁹ low education,¹⁶ and lack of prenatal check-up.¹⁷ However, these risk factors were identified in a research setting, in which participants responded more readily because their identity remained anonymous. To our knowledge, no previous studies have developed a scale to identify mothers with postpartum social problems in a hospital setting, in which mothers cannot remain anonymous, so that we can provide social support for the high-risk mothers identified.

Therefore, the aim of this study was to develop the Social Life Impact for Mother (SLIM) scale to identify mothers with postpartum social problems in a hospital setting in Japan.

2 | MATERIALS AND METHODS

2.1 | Sample

This is a hospital-based prospective study. Obstetrical clinics and hospitals in four populous prefectures in Japan (Kagawa, Miyagi, Oita, and Osaka) were invited to participate, and 58 obstetrical medical institutes agreed to take part. These four prefectures had a population of approximately 13 million (Kagawa, 0.9 million; Miyagi, 2.3 million; Oita, 1.1 million; and Osaka, 8.8 million) with 97 000 births in 2020 (Kagawa, 6900, Miyagi, 16 200, Oita, 8200, Osaka, 65 400) in 214 delivery facilities. The target participants were expectant mothers who were enrolled during prenatal check-up between April 2019 and October 2020 in participating medical care providers. Written informed consent was obtained from all study participants. [Figure 1](#) shows the flow chart of the enrollment process of this study. Questionnaires including the SLIM scale were distributed by medical staff to the target women at prenatal check-up in the first trimester. Postpartum depression and bonding disorders were assessed at a postnatal check-up 1 month after delivery. Questionnaires were filled by the target women in a privacy-protected area in the hospital, and were collected on the same day. Medical information of target women during perinatal periods was collected from medical records. Using the medical record identification numbers, the data were merged. This research was conducted according to the guidelines of the Declaration of Helsinki and was approved by the ethics

review board of the Osaka Women's and Children's Hospital (approval number 1125, date of approval: October 26, 2018).

2.2 | SLIM scale

According to previous studies, possible variables to be used in the SLIM scale were selected. For example, because child maltreatment is related to the various postpartum social problems, young maternal age,⁹ unintended pregnancy,¹⁰ maternal mental disorders,¹¹ and developmental disorders,¹² socioeconomic status,^{9,13} housing instability,¹⁸ social support,⁹ history of childhood abuse,¹⁴ intimate partner violence,¹⁵ marital status,⁹ lower educational achievement,¹⁶ and inadequate prenatal check-ups¹⁷ were selected. Based on these previous studies, we developed the SLIM scale to be applied during the first trimester. We rated the values on each risk factor and assigned a rating scale of zero to two to each. The questions and response items of SLIM scale were developed based on the common questionnaire used in obstetrical clinics and hospitals, as well as the local government. We confirmed that the 12 items of the SLIM scale were appropriate through discussions with experts and sharing of feedback on questionnaire responses from women who had experienced childbirth. The 12 items to be used in the SLIM scale are: (1) "How old are you?" (0 = 25+, 1 = 20–<25, 2 = <20); (2) "How did you feel when you found out you were pregnant this time?" (0 = Happy, 1 = Unexpected but happy, 2 = Unexpected and confused/did not know what to do/no feelings/other); (3) "Do you have a history of psychiatric disorder?" (0 = No, 1 = Yes [past], 2 = Yes [current]); (4) "Do you have difficulties getting along with others and get into trouble?" (0 = No, 1 = Sometimes, 2 = Often); (5) "Are you financially stable?" (0 = Yes, 1 = Not so much, 2 = Not at all); (6) "Do you have a permanent place of residence?" (0 = Yes, 1 = Sometimes change, 2 = Often change); (7) "Do you have someone you can consult with when you really need help?" (0 = A few, 1 = One, 2 = None); (8) "Are you satisfied with the relationship with your parents?" (0 = Yes, 1 = Little, 2 = No); (9) "Do you fight with your partner often?" (0 = No, 1 = Sometimes, 2 = Often); (10) "What is your marital status with your partner?" (0 = Married, 1 = Plan to marry, 2 = Unmarried or remarriage with child); (11) "What is your highest educational level?" (0 = High school or more, 1 = Drop out of high school, 2 = Junior high school); (12) "Did you have a prenatal check-up when you found out you were pregnant?" (0 = Every time, 1 = four times or more, 2 = three times or less). In Japan, the total number of prenatal check-ups is 14. Because it was difficult to assess several risk factors by using self-report questionnaires, we used "Trouble with others" and "Satisfaction of relationship with parents" as indices of developmental disorders and history of child abuse, respectively.

2.3 | Postpartum social problems

Postpartum social problems were assessed by having either PPD (assessed using the Edinburgh Postnatal Depression Scale [EPDS]) or bonding disorder (assessed using the Japanese version of

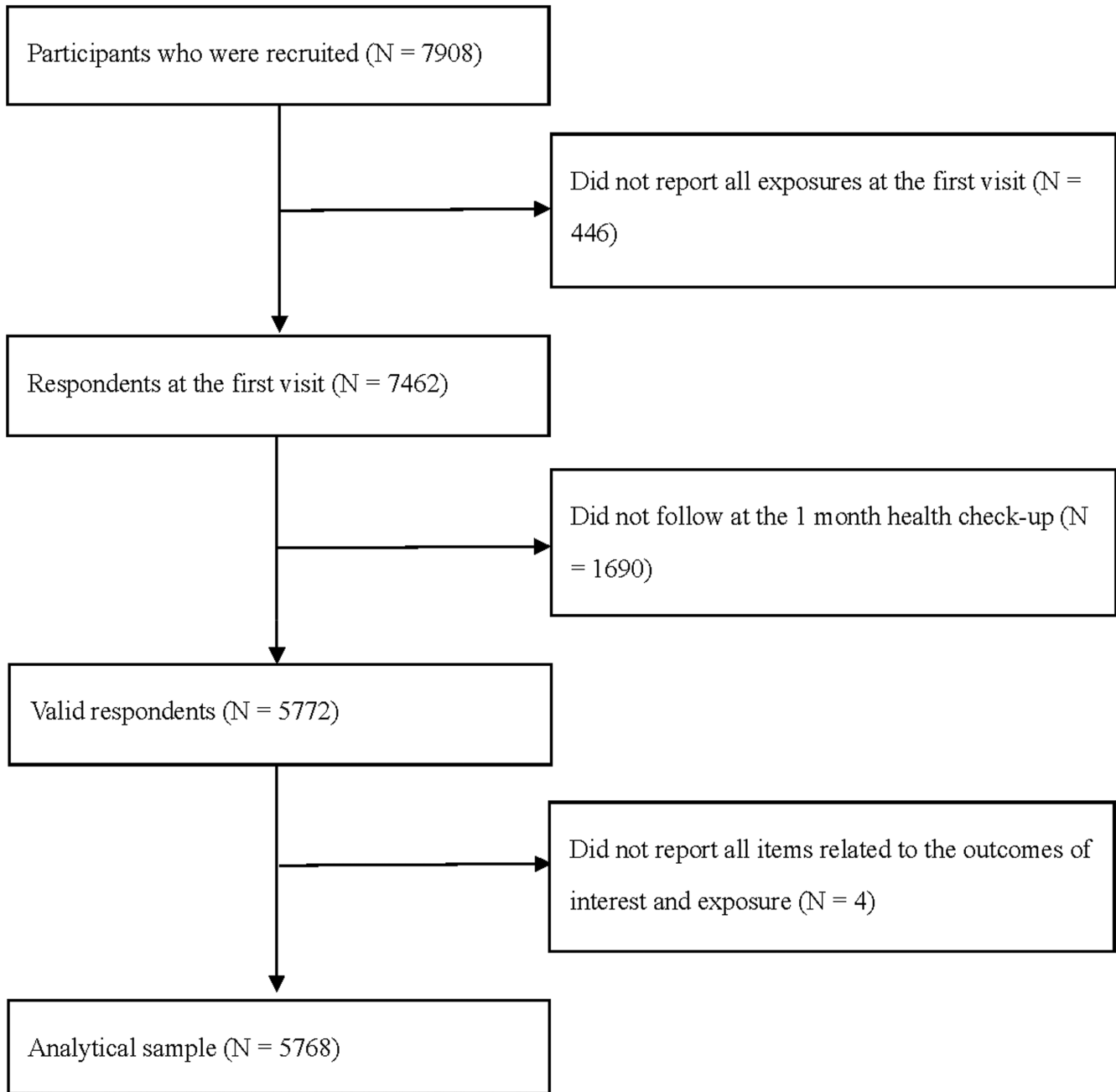


FIGURE 1 Requirement flow chart

Mother-to-Infant Bonding Scale [MIBS-J]¹⁹), at 1 month postpartum. Following the results of a previous community study in Japan, we defined PPD as having an EPDS score of 9 or higher.²⁰ Also, we defined bonding disorders as having a MIBS-J score of 5 or higher.²¹

2.4 | Statistical analysis

The associations between each of the SLIM scale variables and postpartum social problems were analyzed, and odds ratios were calculated using logistic regression. We chose several variables that had strong associations (i.e., point estimate of odds ratio was 1.5 or more), and

summed the value of each variable. We categorized the participants into three groups according to the total score of the SLIM scale, that is, low, middle, and high score. All statistical analyses were conducted using the STATA/MP statistical package, version 15 (StataCorp).

3 | RESULTS

We approached 7908 women to participate in this study. The number of valid responses was 7462 in the first trimester (response rate: 94.4%) and 5772 at the 1-month postpartum health check-up (follow-up rate: 77.4%). Further, we selected an analytical sample

of those who responded to either the EPDS or the bonding scale ($N = 5768$) (see [Figure 1](#)).

[Table 1](#) shows the distribution of possible risk factors assessed in the first trimester. Among the participants, 583 (10.1%) were 24 years old or less, 1586 (27.5%) had an unexpected pregnancy, 320 (5.5%) had a history of psychiatric disorder, 498 (8.7%) had trouble with others, 2353 (40.8%) reported being economically "not rich" or "poor", 391 (6.8%) changed living place, 234 (4.0%) had one or none who could be consulted when in big trouble, 380 (6.6%) were not satisfied with the relationship with their parents, 143 (2.5%) reported frequent fights with their partner during the pregnancy, 540 (9.4%) were not married, and 248 (4.3%) did not graduate from high school. Further, 40 (0.7%) did not attend every prenatal check-up.

[Table 2](#) shows the distribution of EPDS score, bonding score, and postpartum social problems (i.e., either EPDS or bonding disorders). The overall number and prevalence of PPD (an EPDS score ≥ 9) and bonding disorders (a MIBS-J score ≥ 5) at 1 month postpartum were 471 (8.2%) and 428 (7.4%), respectively. Also, the overall number and prevalence of postpartum social problems was 744 (12.9%).

[Table 3](#) shows the odds ratio (ORs) for each item of SLIM scale on postpartum social problems. The ORs of "Trouble with others" and "Having someone to consult when in big trouble" were 3.22 (95% confidence interval [CI] 2.66–3.90, $P < 0.001$) and 2.69 (95% CI 2.06–3.52, $P < 0.001$), respectively. The ORs of "History of psychiatric disorder" (OR 2.17, 95% CI 1.78–2.63, $P < 0.001$), "Financial status" (OR 1.52, 95% CI 1.34–1.74, $P < 0.001$), "Change of living place" (OR 1.57, 95% CI 1.25–1.98, $P < 0.001$), and "Satisfaction of relationship with parents" (OR 1.93, 95% CI 1.59–2.34, $P < 0.001$) were also significantly positively associated with postpartum social problems at around an OR of 2. Further, "Feelings when pregnancy was confirmed" (OR 1.41, 95% CI 1.24–1.62, $P < 0.001$) and "Fight with partner" (OR 1.33, 95% CI 1.16–1.53, $P < 0.001$) were also significantly positively associated with postpartum social problems but with an OR of less than 1.5. Based on these ORs, we weighted three times values on "Trouble with others" and "Having someone to consult with when in big trouble." Similarly, we weighted two times for "History of psychiatric disorder," "Financial status," "Change of living place", and "Satisfaction of relationship with parents." Further, based on discussions with experts, we decided to use "Maternal age", although this had a non-significant association in the present study (OR 0.91, 95% CI 0.72–1.15, $P = 0.407$), because younger age has been established as a risk factor for child maltreatment.⁹ Finally, the SLIM scale includes nine risk factors with scores ranging from zero to 34 (see [Appendix A](#)).

According to the total SLIM scale score, we divided the women into three categories: Low (SLIM 0–4), Middle (SLIM 5–10), and High (SLIM 11–34) based on the distribution as shown in [Table 4](#). The OR of having postpartum social problems in the Middle and High categories was 2.58 (95% CI 2.15–2.10, $P < 0.001$) and 6.73 (95% CI 4.54–9.99, $P < 0.001$), respectively. The SLIM categories showed an association with "high-risk mother" (area under the curve 0.63, 95% CI 0.60–0.65).

4 | DISCUSSION

We developed the SLIM scale to identify mothers who may need social support at 1 month postpartum. The scale was feasible for use in a hospital setting in Japan at the first trimester. We identified two risk factors, "Trouble with others" and "Having someone to consult with when in big trouble", but in contrast, maternal age, marital status, education level, and number of prenatal check-ups, were not associated with postpartum social problems.

Because teen pregnancy²² and an age of 20–24 years old⁹ are considered as risk factors for child maltreatment, we divided maternal age into under 20 years old, 20–24 years old, and 25 years old and older. Although we found a non-significant association between maternal age and postpartum social problems in this study, we chose it as an index for the SLIM scale because pregnant teenagers may have already received high social support during pregnancy from a municipality, which might prevent PPD and bonding disorders. Social support for pregnant teenagers in Japan in recent years might be different from that in countries in which previous studies were conducted because of cultural and generational differences (i.e., 1993 and 2000). In addition, younger mothers were more likely to drop out of the present study (drop-out rates: under 20 years old, 20–24 years old, and 25 years old and older were 28.0%, 23.0%, and 22.6%, respectively), our findings on the non-association between young age and mothers who need social support might be underestimated. Further study using a sample with high retention rate, such as that of an anonymous internet survey, is needed.

The findings of the association between each item of the SLIM scale and postpartum social problems were consistent with those of previous studies. Women's feelings when pregnancy was confirmed have been identified as a risk factor at the 3-month neonatal health check-up in Japan.¹⁰ Because in this study we asked for women's feelings during a prenatal check-up, it is less likely that the women had forgotten about the first impression about their pregnancy. History of psychiatric disorder is an established risk factor for child maltreatment and PPD.¹¹ We divided this factor into past and current because the suicide risk varies according to the type and duration of psychiatric disorder.¹¹ Further, the association between maternal developmental disorder traits and child mistreatment was shown in a previous study.¹² Because it was difficult to directly ask a woman whether or not she had developmental disorders, we used "Trouble with others" as an index of developmental disorders for the self-report questionnaires. As for social factors, a number of previous studies reported that poverty is a risk factor for child maltreatment or PPD.¹³ Similar to poverty, housing instability was reported as a risk factor for intimate partner violence.¹⁸ In addition to physical social environment, social support should be considered, as a lack of such support was also reported as a risk factor for child maltreatment and PPD.⁹ Although previous reviews did not conclude whether childhood abused history was an associated factor, owing to methodological issues,²³ one of the most robust risk factors for child maltreatment is history of childhood maltreatment. Several reports from Japan showed the association between maternal history

TABLE 1 Distribution of possible risk factors

| | Prefecture | | | | | | | | | | |
|---|------------|------|-------------------------|------|--------------------------|------|------------------------|------|------------------------|------|----------------------|
| | Total | | Osaka (N = 1876, 32.5%) | | Miyagi (N = 1067, 18.5%) | | Kagawa (N = 190, 3.3%) | | Oita (N = 2635, 45.7%) | | P value ^a |
| | N | % | N | % | N | % | N | % | N | % | |
| Maternal age, years | | | | | | | | | | | |
| 25+ | 5173 | 89.7 | 1691 | 90.1 | 965 | 90.4 | 164 | 86.3 | 2353 | 89.3 | 0.032 |
| 20 to <25 | 529 | 9.2 | 158 | 8.4 | 85 | 8.0 | 23 | 12.1 | 263 | 10.0 | |
| <20 | 54 | 0.9 | 25 | 1.3 | 12 | 1.1 | 1 | 0.5 | 16 | 0.6 | |
| Missing | 12 | 0.2 | 2 | 0.1 | 5 | 0.5 | 2 | 1.1 | 3 | 0.1 | |
| Feelings when pregnancy was confirmed | | | | | | | | | | | |
| Happy | 4176 | 72.4 | 1389 | 74 | 760 | 71.2 | 140 | 73.7 | 1887 | 71.6 | 0.504 |
| Unexpected but happy | 1402 | 24.3 | 424 | 22.6 | 267 | 25.0 | 44 | 23.2 | 667 | 25.3 | |
| Unexpected and confused/did not know what to do/no feelings/other | 184 | 3.2 | 61 | 3.3 | 37 | 3.5 | 6 | 3.2 | 80 | 3.0 | |
| Missing | 6 | 0.1 | 2 | 0.1 | 3 | 0.3 | 0 | 0 | 1 | 0 | |
| History of psychiatric disorder | | | | | | | | | | | |
| No | 5442 | 94.3 | 1762 | 93.9 | 1005 | 94.2 | 185 | 97.4 | 2490 | 94.5 | 0.538 |
| Yes (past) | 248 | 4.3 | 83 | 4.4 | 47 | 4.4 | 4 | 2.1 | 114 | 4.3 | |
| Yes (current) | 72 | 1.2 | 29 | 1.5 | 13 | 1.2 | 1 | 0.5 | 29 | 1.1 | |
| Missing | 6 | 0.1 | 2 | 0.1 | 2 | 0.2 | 0 | 0 | 2 | 0.1 | |
| Trouble with others | | | | | | | | | | | |
| No | 5266 | 91.3 | 1733 | 92.4 | 957 | 89.7 | 174 | 91.6 | 2402 | 91.2 | 0.200 |
| Sometimes | 472 | 8.2 | 136 | 7.2 | 102 | 9.6 | 14 | 7.4 | 220 | 8.3 | |
| Often | 26 | 0.5 | 6 | 0.3 | 7 | 0.7 | 2 | 1.1 | 11 | 0.4 | |
| Missing | 4 | 0.1 | 1 | 0.1 | 1 | 0.1 | 0 | 0 | 2 | 0.1 | |
| Financial status | | | | | | | | | | | |
| Rich | 3402 | 59.0 | 1149 | 61.2 | 602 | 56.4 | 117 | 61.6 | 1534 | 58.2 | 0.163 |
| Not rich | 2169 | 37.6 | 665 | 35.4 | 428 | 40.1 | 67 | 35.3 | 1009 | 38.3 | |
| Poor | 184 | 3.2 | 53 | 2.8 | 36 | 3.4 | 6 | 3.2 | 89 | 3.4 | |
| Missing | 13 | 0.2 | 9 | 0.5 | 1 | 0.1 | 0 | 0 | 3 | 0.1 | |
| Change of living place | | | | | | | | | | | |
| No | 5375 | 93.2 | 1760 | 93.8 | 1001 | 93.8 | 182 | 95.8 | 2432 | 92.3 | 0.136 |
| Sometimes | 357 | 6.2 | 101 | 5.4 | 61 | 5.7 | 8 | 4.2 | 187 | 7.1 | |
| Often | 34 | 0.6 | 14 | 0.7 | 5 | 0.5 | 0 | 0 | 15 | 0.6 | |
| Missing | 2 | 0.03 | 1 | 0.1 | 0 | 0 | 0 | 0 | 1 | 0.04 | |
| Having someone to consult with when in big trouble | | | | | | | | | | | |
| A few | 5531 | 95.9 | 1798 | 95.8 | 1026 | 96.2 | 187 | 98.4 | 2520 | 95.6 | 0.562 |
| One | 220 | 3.8 | 72 | 3.8 | 37 | 3.5 | 3 | 1.6 | 108 | 4.1 | |
| None | 14 | 0.2 | 4 | 0.2 | 4 | 0.4 | 0 | 0 | 6 | 0.2 | |
| Missing | 3 | 0.1 | 2 | 0.1 | 0 | 0 | 0 | 0 | 1 | 0.04 | |

TABLE 1 (Continued)

| | Total | | Prefecture | | | | | | | | P value ^a |
|---|-------|------|-------------------------|------|--------------------------|------|------------------------|------|------------------------|------|----------------------|
| | | | Osaka (N = 1876, 32.5%) | | Miyagi (N = 1067, 18.5%) | | Kagawa (N = 190, 3.3%) | | Oita (N = 2635, 45.7%) | | |
| | N | % | N | % | N | % | N | % | N | % | |
| Satisfaction of relationship with parents | | | | | | | | | | | |
| Yes | 5369 | 93.1 | 1771 | 94.4 | 979 | 91.8 | 180 | 94.7 | 2439 | 92.6 | 0.024 |
| Little | 313 | 5.4 | 82 | 4.4 | 64 | 6.0 | 6 | 3.2 | 161 | 6.1 | |
| No | 67 | 1.2 | 17 | 0.9 | 18 | 1.7 | 4 | 2.1 | 28 | 1.1 | |
| Missing | 19 | 0.3 | 6 | 0.3 | 6 | 0.6 | 0 | 0 | 7 | 0.3 | |
| Fight with partner | | | | | | | | | | | |
| No | 2960 | 51.3 | 979 | 52.2 | 557 | 52.2 | 93 | 48.9 | 1331 | 50.5 | 0.636 |
| Sometimes | 2648 | 45.9 | 846 | 45.1 | 481 | 45.1 | 95 | 50 | 1226 | 46.5 | |
| Often | 143 | 2.5 | 44 | 2.3 | 28 | 2.6 | 2 | 1.1 | 69 | 2.6 | |
| Missing | 17 | 0.3 | 7 | 0.4 | 1 | 0.1 | 0 | 0 | 9 | 0.3 | |
| Marital status | | | | | | | | | | | |
| Married | 5221 | 90.5 | 1683 | 89.7 | 975 | 91.4 | 177 | 93.2 | 2386 | 90.6 | 0.095 |
| Plan to marry | 374 | 6.5 | 128 | 6.8 | 54 | 5.1 | 10 | 5.3 | 182 | 6.9 | |
| Unmarried/remarried with children | 166 | 2.9 | 61 | 3.3 | 38 | 3.6 | 3 | 1.6 | 64 | 2.4 | |
| Missing | 7 | 0.1 | 4 | 0.2 | 0 | 0 | 0 | 0 | 3 | 0.1 | |
| Education level | | | | | | | | | | | |
| High school or more | 5518 | 95.7 | 1770 | 94.3 | 1022 | 95.8 | 187 | 98.4 | 2539 | 96.4 | 0.002 |
| Drop out of high school | 157 | 2.7 | 64 | 3.4 | 35 | 3.3 | 1 | 0.5 | 57 | 2.2 | |
| Junior high school | 91 | 1.6 | 42 | 2.2 | 10 | 0.9 | 2 | 1.1 | 37 | 1.4 | |
| Missing | 2 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.1 | |
| Number of prenatal check-ups | | | | | | | | | | | |
| Every time | 4964 | 86.1 | 1391 | 74.2 | 908 | 85.1 | 179 | 94.2 | 2486 | 94.3 | 0.992 |
| Four times or more | 34 | 0.6 | 8 | 0.4 | 6 | 0.6 | 1 | 0.5 | 19 | 0.7 | |
| Three times or less | 6 | 0.1 | 2 | 0.1 | 1 | 0.1 | 0 | 0 | 3 | 0.1 | |
| Missing | 764 | 13.3 | 475 | 25.3 | 152 | 14.2 | 10 | 5.3 | 127 | 4.8 | |

^aP values using chi-squared test.

of child abuse and their own child maltreatment or their psychiatric disease.¹⁴ As it was difficult to ask for maternal history of child abuse in a hospital setting, we used "Satisfaction of relationship with parents" as an index of history of child abuse for self-report questionnaires. In conjunction with childhood maltreatment history, intimate partner violence¹⁵ and unmarried status⁹ are also risk factors for child maltreatment, and intimate partner violence was confirmed to be associated with mothers who need social support during the postpartum period.

Lower education was related to physical punishment of children in Japan.¹⁶ In this study, however, we found that several factors, such as maternal education and prenatal check-up, were not significantly associated with postpartum social problems. Education until the completion of junior high school is mandatory in Japan, so we rated

this index as "junior high school", "drop out of high school", and "high school or higher." This might have led to sampling bias, i.e. mothers with lower education were more likely to drop out. Hence, we did not find an association between maternal education and postpartum social problems. Inadequate prenatal check-ups were associated with increased risk of physical child abuse,¹⁷ but it was not the case in the present study. When asking the number of prenatal check-ups, we used three times or less as inadequateness according to the Japanese guideline for pregnant women with inadequate prenatal check-ups. Again, we need to recategorize the frequency of prenatal check-ups, such as those who had no prenatal check-ups.

The novelty of this study is that we selected and weighted nine risk factors as the SLIM score, which ranges from 0 to 34, and categorized them into three groups—low (SLIM score: 0–4), middle (SLIM

TABLE 2 Distribution of Edinburgh Postnatal Depression Scale (EPDS) score, bonding score, and postpartum social problems^a

| | Total | Prefecture | | | | | | | | P value ^b | |
|----------------------------|-------|------------|--------|--------|------|-------|------|-------|------|----------------------|--------|
| | | Osaka | Miyagi | Kagawa | Oita | | | | | | |
| EPDS score | | | | | | | | | | | |
| Total score | 3.23 | ±3.45 | 3.34 | ±3.31 | 2.76 | ±3.19 | 2.64 | ±3.41 | 3.38 | ±3.62 | <0.001 |
| Category | | | | | | | | | | | |
| <9 | 5231 | 90.7% | 1705 | 90.9% | 975 | 91.4% | 177 | 93.2% | 2374 | 90.1% | <0.001 |
| 9+ | 471 | 8.2% | 145 | 7.7% | 63 | 5.9% | 13 | 6.8% | 250 | 9.5% | |
| Missing | 66 | 1.1% | 26 | 1.4% | 29 | 2.7% | 0 | 0% | 11 | 0.4% | |
| Bonding score | | | | | | | | | | | |
| Total score | 1.45 | ±2.17 | 1.70 | ±2.32 | 1.01 | ±1.72 | 1.08 | ±1.68 | 1.48 | ±2.24 | <0.001 |
| Category | | | | | | | | | | | |
| <5 | 5254 | 91.1% | 1624 | 86.6% | 1017 | 95.3% | 182 | 95.8% | 2431 | 92.3% | <0.001 |
| 5+ | 428 | 7.4% | 174 | 9.3% | 46 | 4.3% | 8 | 4.2% | 200 | 7.6% | |
| Missing | 86 | 1.5% | 78 | 4.2% | 4 | 0.4% | 0 | 0% | 4 | 0.2% | |
| Postpartum social problems | | | | | | | | | | | |
| Low | 5024 | 87.1% | 1612 | 85.9% | 975 | 91.4% | 172 | 90.5% | 2265 | 86.0% | <0.001 |
| High | 744 | 12.9% | 264 | 14.1% | 92 | 8.6% | 18 | 9.5% | 370 | 14.0% | |

^aData are presented as means ± standard deviation or as number and percentage.

^bP for analysis of variance or chi-squared test.

TABLE 3 Results of logistic regression to predict mothers with postpartum social problems by information at first trimester

| | OR (95%CI) | P value |
|---|------------------|---------|
| Maternal age | 0.91 (0.72–1.15) | 0.407 |
| Feelings when pregnancy was confirmed | 1.41 (1.24–1.62) | <0.001 |
| History of psychiatric disorder | 2.17 (1.78–2.63) | <0.001 |
| Trouble with others | 3.22 (2.66–3.90) | <0.001 |
| Financial status | 1.52 (1.34–1.74) | <0.001 |
| Change of living place | 1.57 (1.25–1.98) | <0.001 |
| Having someone to consult when in big trouble | 2.69 (2.06–3.52) | <0.001 |
| Satisfaction of relationship with parents | 1.93 (1.59–2.34) | <0.001 |
| Fight with partner | 1.33 (1.16–1.53) | <0.001 |
| Marital status | 1.13 (0.95–1.35) | 0.174 |
| Education level | 1.23 (0.98–1.56) | 0.077 |
| Number of prenatal check-ups | 1.51 (0.79–2.86) | 0.211 |

Abbreviations: CI, confidence intervals, OR, odds ratio.

TABLE 4 Odds ratio of categorized SLIM score and postpartum social problems

| Social Life Impact for Mother (SLIM) | N | % | OR (95% CI) | P value |
|--------------------------------------|------|------|------------------|---------|
| Total score (0–34) | | | 1.18 (1.15–1.20) | <0.001 |
| Category | | | | |
| Low (0–4) | 4667 | 82.0 | Ref. | |
| Middle (5–10) | 919 | 16.1 | 2.58 (2.15–3.10) | <0.001 |
| High (11–34) | 107 | 1.9 | 6.73 (4.54–9.99) | <0.001 |

Abbreviations: CI, confidence intervals, OR, odds ratio; SLIM, Social Life Impact for Mother.

score: 5–10), and high (SLIM score: 11–34)—to identify mothers who need social support during pregnancy with moderate predictability (area under the curve = 0.63). Our findings suggest that applying the SLIM scale at the first trimester may be useful in detecting women who have postpartum social problems in a hospital setting.

The current study is also helpful when it comes to preventing postpartum social problems by identifying high-risk mothers and to provide social support promptly from the first trimester. Social support programs on parenting include financial and psychosocial support, and such programs are based on home visits carried out by health professionals, center-based parenting programs, and peer-to-peer groups. Nurse-managed home-visiting programs in the USA have resulted in improved maternal mental and physical status, and in Europe, community-based postpartum care programs by healthcare professionals are provided. In the USA, the Nurse-Family Partnership is a home-visiting program for families that covers the start of the pregnancy period through to when the child is 2 years old. In Japan, families with newborns are entitled to the “Hello Baby” home-visiting program conducted by public health nurses or midwives until the baby is 4 months old. Following that, the families receive infant health check-ups at 4 months, 1.5 years, 3 years, and 5 years at a municipal health center. We propose that public health nurses should focus on mothers with high SLIM scores and should provide the necessary support continuously.

Nonetheless, we acknowledge that our study has several limitations. First, we may have selection bias due to social desirability. Because mothers are generally expected to accept their babies, participants may underreport their feelings against babies in the Mother-to-Infant Bonding Scale, especially when surveys were not anonymous. Also, women with PPD are often hesitant to divulge their mood and anxiety symptoms because of the guilt of having such symptoms when motherhood is expected to be a joyful event. Second, there might be measurement errors due to the survey being self-reported. We used “Satisfaction of relationship with parents” as an index of maternal history of childhood abuse. It is known that retrospective reports in adulthood of major adverse childhood experiences might be underestimated when self-reported.²⁴ Further, such experiences might be underreported due to the unwillingness of individuals to disclose embarrassing events or painful memories. We considered that it may be possible to estimate the history of childhood abuse by asking pregnant women about their relationship with parents, because history of childhood abuse could be regarded as an insufficiency of parent-child relationship. Third, although we collected postpartum data at the 1-month health check-up of infants, timing and frequency of survey can be controversial. PPD is defined strictly in the psychiatric nomenclature as a major depressive disorder with a specifier of postpartum onset within 1 month after childbirth.² However, depression in women during the postpartum period may start during pregnancy or may have onset beyond the first postpartum month. According to previous data, women generally increase in bonding with their infant 6 months postpartum.²⁵ Further study is needed to determine if the SLIM can predict women's long-term mental problems. Finally, we extracted women with postpartum social problems in this study, but these women may not

necessarily maltreat their children. Further development of a more accurate SLIM scale is warranted.

In conclusion, the present study suggested that the use of the SLIM scale at prenatal check-up in a hospital setting might be effective for obstetricians to detect mothers who will need social support postpartum. There is a need to investigate whether offering appropriate social support for the identified mothers would prevent child maltreatment.

AUTHOR CONTRIBUTIONS

NM and TF conceptualized and designed the study and supervised the analysis, and undertook the critical revision of the manuscript. NM, YO, JS, KM, and SS conducted the survey. YO conducted literature searches, provided summaries of previous research studies, and wrote the first draft of the manuscript. SD and AI conducted the statistical analysis. TF, SD, AI, NM, JS, KM, SS, and NM revised the draft of the manuscript critically. All authors have approved the final manuscript.

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CONFLICT OF INTEREST

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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APPENDIX A

| Rating scale | 0 | 1 | 2 | Weight of score |
|---|-------|----------------------|---|-----------------|
| Maternal age "How old are you?" | 25+ | 20- <25 | <20 | 1 |
| Feelings when pregnancy was confirmed "How did you feel when you found out you were pregnant this time?" | Happy | Unexpected but happy | Unexpected and confused/did not know what to do/no feelings/other | 1 |
| History of psychiatric disorder "Do you have a history of psychiatric disorder?" | No | Yes (past) | Yes (current) | 2 |
| Trouble with others "Do you have difficulties getting along with others and get into trouble?" | No | Sometimes | Often | 3 |
| Financial status "Are you financially stable?" | Yes | Not so much | Not at all | 2 |
| Change of living place "Do you have a permanent place of residence?" | Yes | Sometimes change | Often change | 2 |
| Having someone who can consult with in big trouble "Do you have someone you can consult with when you really need help?" | A few | One | None | 3 |
| Satisfaction of relationship with parents "Are you satisfied with the relationship with your parents?" | Yes | Little | No | 2 |
| Fight with partner "Do you fight with your partner often?" | No | Sometimes | Often | 1 |