

Research paper

The prevalence and risk factors of suicidal ideation in women with and without postpartum depression

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ARTICLE INFO

Keywords:

Postpartum depression
Edinburgh Postnatal Depression Scale
Self-harm
Suicidal ideation
Risk factors

ABSTRACT

Aim: Suicidal ideation (SI) is a severe mental health issue in the postpartum period. As depression is a major risk factor of SI, it is often considered that the risk factors of SI are the same as those of postpartum depression. However, SI occurs in women without postpartum depression as well. The aim of this study is to separately examine the prevalence and risk factors of SI in postpartum women with and without depression.

Methods: We used data of 5688 postpartum women from a 2021 Japanese nation-wide survey, whose age and geographical distributions were nationally representative. Postpartum depression was evaluated with the Edinburgh Postnatal Depression Scale (EPDS) and SI was measured with the 10th item of EPDS.

Results: The prevalence of SI in women with and without depression (EPDS ≥ 9) was 51.8 % and 3.3 %, respectively. Younger age and low family support were risk factors common to both women with and without depression. Being single, currently working, history of depressive disorders, and family members' visits to support being cancelled were risk factors of SI for women with depression. In contrast, primipara, history of psychiatric disorders other than depressive disorders, infectious disease other than colds during pregnancy, and feeling of loneliness increased since COVID-19 were risk factor of SI for women without depression.

Conclusion: Although with a low prevalence, SI occurs in women without postpartum depression, which has unique risk factors indicating distinct psychopathological mechanisms. These findings call for tailored SI intervention strategies according to whether postpartum depression is present or not.

1. Introduction

Suicide is a leading cause of maternal death in pregnancy and the postpartum (Lindahl et al., 2005; Goldman-Mellor and Margerison, 2019; Takeda, 2020). Suicidal ideation (SI), a major risk factor and trigger of suicide and self-harm (Klonsky et al., 2016), has been receiving much attention in primary care and research. However, the risk factors of SI are not well understood. Given that depression is a key risk factor of SI (Nock et al., 2014), it is often considered that the risk factors of SI are the same as those of perinatal depression (Orsolini et al., 2016; Bright et al., 2022; Reid et al., 2022). It is only recently that researchers started to investigate the risk factors of perinatal SI. According to a 2022 systematic review of studies of the risk factors of SI, 62.5 % of the studies were published in the last five years and 87.5 % in the last

decade (Reid et al., 2022). Unfortunately, however, in these studies, perinatal depression is either not considered (e.g., Enătescu et al., 2021; Kalmbach et al., 2021) or only statistically controlled as a covariate (e.g., Doi and Fujiwara, 2019; Abdelghani et al., 2021). As a result, risk factors of SI in the presence of perinatal depression versus that in the absence of perinatal depression are unclear.

On one hand, knowledge on the risk factors of SI in the presence of perinatal depression may advance our understanding of the strong link between depression and SI (Nock et al., 2014) and promote selective prevention and treatment of SI in women with perinatal depression. On the other hand, knowledge on the risk factors of SI in the absence of perinatal depression may provide important insights into the psychopathology of SI independent of perinatal depression, which also facilitates tailored strategies for the prevention and treatment of SI.

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<https://doi.org/10.1016/j.jad.2023.08.051>

Received 28 February 2023; Received in revised form 8 August 2023; Accepted 9 August 2023

Available online 10 August 2023

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In the current study, we aimed to address this issue and separately investigated the prevalence and risk factors of SI in postpartum women with and without depression. Specifically, based on the Edinburgh Postnatal Depression Scale (EPDS), we divided 5688 postpartum women from a 2021 Japanese nation-wide survey into those with depression ($EPDS \geq 9$, $n = 1378$) and without depression ($EPDS < 9$, $n = 4310$). We then investigated the risk factors of SI in these two groups of subjects respectively.

2. Methods

2.1. Subjects

We employed data of a Japanese nation-wide study called the Japan COVID-19 and Society Internet Survey (JACSIS) conducted in July and August 2021. The JACSIS collected data from pooled panels of a Japanese internet research and marketing agency (Rakuten Insight, Inc.). We used data of the pregnant/postpartum mother panel, in which the age and geographical distributions of the subjects were nationally representative (Hosokawa et al., 2022). More comprehensive descriptions of the JACSIS are available in published papers (Zaitzu et al., 2021; Hosokawa et al., 2022; Okawa et al., 2022). The final sample comprises 5688 postpartum women. Informed consent was collected from all subjects. The study protocol was approved by the Research Ethics Committee of the Osaka International Cancer Institute (No. 20084).

2.2. Postpartum depression and suicidal ideation

The Edinburgh Postnatal Depression Scale (EPDS) was employed to assess postpartum depression (Cox et al., 1987; Okano, 1996). EPDS is the most popular screening tool of postpartum depression in primary care. A cutoff of 9 has been commonly used in Japanese subjects to indicate the presence of postpartum depression (Okano, 1996; The Japan Society of Obstetrics and Gynecology, 2017). The 10th item of EPDS was used to assess SI. This item asks subjects to indicate the frequency of “The thought of harming myself has occurred to me” on a 4-point scale, with 0 indicating never, 1 indicating hardly ever, 2 indicating sometimes, and 3 indicating yes, quite often. An answer of 1 or above is commonly used to define the presence of SI (Xiao et al., 2022).

2.3. Social-demographic, pregnancy, childbirth, and COVID-19 related factors

The following information was extracted for all subjects: age, education, marital status, parity, employment, partner employment, last year's family income, any current physical illness (including hypertension, diabetes, asthma, cancer or malignant tumor, chronic kidney disease, autoimmune disease), history of depressive disorders, history of psychiatric disorders other than depressive disorders, alcohol drinking, smoking, any pregnancy complications (including preeclampsia, gestational diabetes, imminent preterm birth, placenta previa, placenta detaches early, early water breaking, imminent miscarriage, worsening pre-pregnancy disease, hyperemesis gravidarum requiring hospitalization, proteinuria defined as ++ or higher, and fetus health problems), history of infectious disease other than colds during pregnancy, childhood adverse experience (including loss of a parent, parents divorced, had a parent with schizophrenia, mother being physical abused by father, being physically abused, being neglected, being verbally abused, economic hardship, being bullied, being sexually abused), family support (as measured by the Family APGAR Scale, Smilkstein, 1978; a score of 15 indicates the highest family support), intimate partner violence since January 2021 (including both physical and verbal), feeling loneliness increased after the outbreak of COVID-19, mode of childbirth (vaginal delivery, emergency caesarean section, planned caesarean section), preterm birth (<37 weeks), low birth weight (<2500 g), postpartum period (0–3 months, 4–6 months, 7–12 months, 13–18

months, 19–31 months), breastfeeding terminated or not, whether gave up hometown delivery, whether parents or other family members' visits to support during the first month after delivery was cancelled, whether being able to ask advice of doctors or midwives about health after delivery, and whether being able to ask advice of friends about breastfeeding or childcare after delivery.

Importantly, for questions related to medical conditions, we asked all subjects to check their Maternal and Child Health Handbook, the records of which were made by healthcare professionals.

2.4. Statistical analysis

We first calculated the prevalence of SI for all subjects and for subjects with and without postpartum depression, respectively. This included reporting any SI and SI at each frequency (i.e., hardly ever, sometimes, often). We then compared the prevalence of SI among each social-demographic, pregnancy, childbirth, and COVID-19 related factors using chi-square tests or Fisher's exact tests (if the expected value of a cell was below 5). Sixteen variables were found to be related to SI in either women with or without depression, which were therefore included in subsequent logistic regression for the detection of risk factors of SI. We considered our sample size appropriately powered for a logistic regression with sixteen independent variables based on the sample size calculation proposed by Riley et al. (2020). Specifically, our sample size was sufficient to produce a precise estimate of the outcome risk with a margin of error no >0.05 and a mean absolute error in predicted probabilities no >0.05, assuming the anticipated model performance defined by the I-Snell R^2 being 0.15. Additionally, we conducted another analysis to investigate the presence of specific depressive symptoms (i.e., the first nine items of EPDS) as predictors of SI using logistic regression separately in women with and without depression. All analyses were conducted with SPSS 26 and p values <0.05 were considered statistically significant.

3. Results

3.1. Prevalence of suicidal ideation

The overall prevalence of SI was 15.1 % in postpartum. The prevalence of SI in postpartum women with and without depression was 51.8 % and 3.3 %, respectively. Detailed prevalence of SI as well as different frequencies of SI according to postpartum periods is shown in Fig. 1. For different postpartum periods, the prevalence of SI ranged from 45.4 % to 55.1 % for women with depression, and from 2.7 % to 4.6 % for women without depression.

Subjects characteristics according to SI and depression status are shown in Table 1. For postpartum women with depression, those with the following characteristics were more likely to have SI: being single, currently working, partner being a company executive, currently suffering from physical illness, self-reported history of depressive or other psychiatric disorders, low family support, being a victim of intimate partner violence, feeling loneliness increased after the outbreak of COVID-19, family members' visits to support during the 1st month after delivery being cancelled, and being unable to ask advice of doctors or midwives about health after delivery despite needs. For postpartum women without depression, those with the following characteristics were more likely to have SI: younger age, primipara, lower family income, history of depressive or other psychiatric disorders, infectious disease other than colds during pregnancy, childhood adverse experience, low family support, being a victim of intimate partner violence, and feeling loneliness increased after the outbreak of COVID-19.

3.2. Risk factors of suicidal ideation

We used logistic regression to identify risk factors of SI in postpartum women with and without depression, respectively. The results are shown

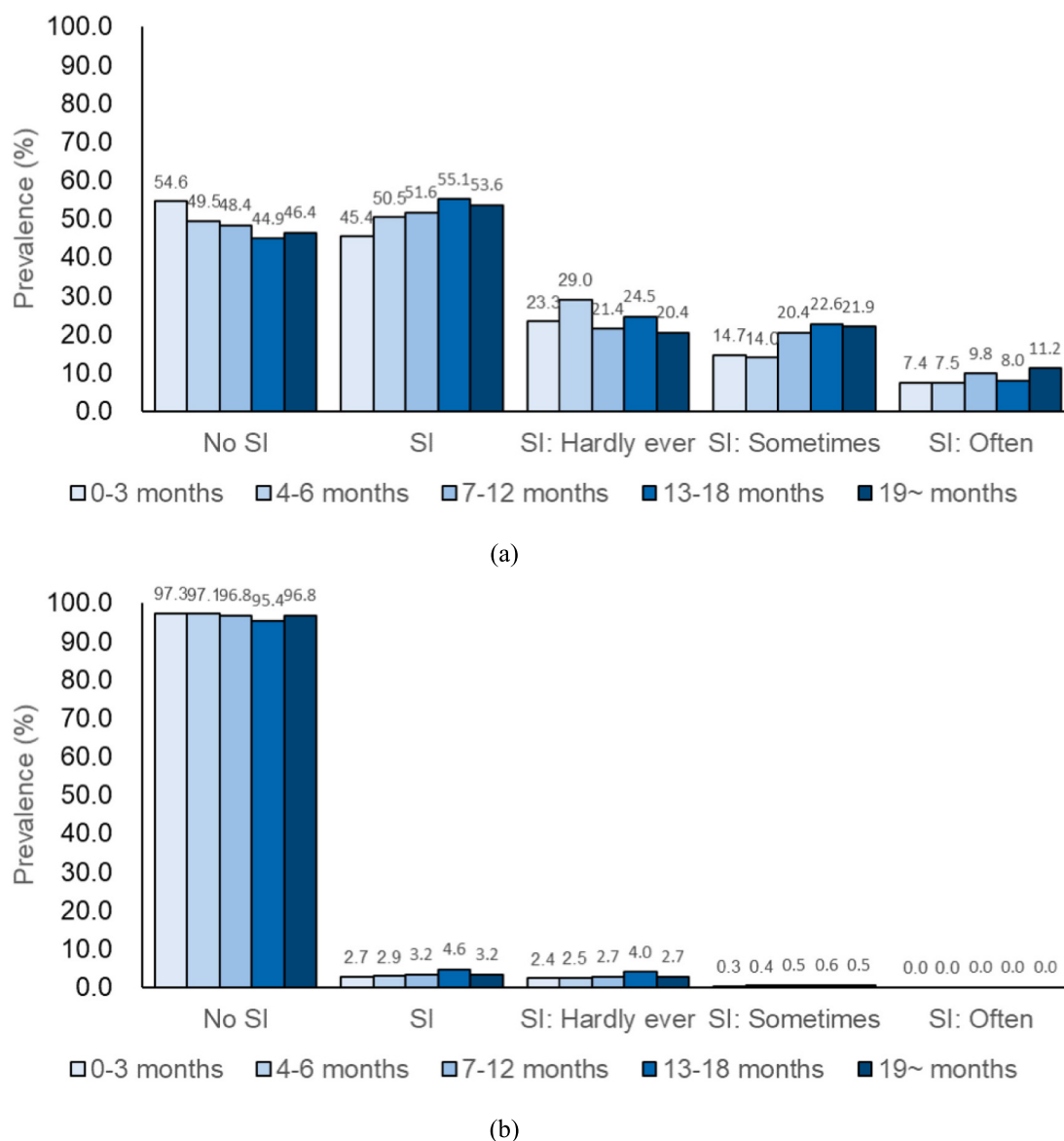


Fig. 1. The prevalence of suicidal ideation in postpartum women with and without depression for different postpartum periods. (a), Prevalence in postpartum women with depression (EPDS ≥ 9). (b), Prevalence in postpartum women without depression (EPDS < 9).

in Table 2.

Whereas younger age and low family support are risk factors of SI common to both women with and without depression, the two groups also had their respective, unique risk factors. Risk factors of SI for women with depression included being single (OR = 2.861, 95%CI [1.149, 7.121]), currently working (being unemployed compared to currently working, OR = 0.699, 95%CI [0.524, 0.932]), history of depressive disorders (recent, OR = 3.809, 95%CI [1.895, 7.657]), and family members' visits to support during the 1st month after delivery being cancelled (OR = 1.350, 95%CI [1.026, 1.777]). In contrast, risk factors of SI for women without depression included primipara (OR = 1.476, 95%CI [1.031, 2.112]), history of psychiatric disorders other than depressive disorder (ever, OR = 2.545, 95%CI [1.305, 4.962]), infectious disease other than colds during pregnancy (OR = 2.874, 95%CI [1.381, 5.981]), and more frequent feeling of loneliness increased after the outbreak of COVID-19 (OR = 1.754, 95%CI [1.089, 2.826] for feeling "mostly" lonely, OR = 2.026, 95%CI [1.309, 3.134] for feeling "always" lonely).

3.3. The association between individual depressive symptoms and suicidal ideation

We also investigated if the presence of specific depressive symptoms predicts SI in women with and without depression, respectively. As reported in Table 3, shared risk factors of SI in women with and without depression included sadness (OR = 1.753 and 2.985, respectively) and tears (OR = 3.379 and 1.788, respectively). Unique risk factors of SI in women with depression were the absence of enjoyment and the presence of fear and insomnia (OR = 1.347–2.035). Somewhat unexpectedly, anxiety was a protective factor of SI in women with depression (OR = 0.634). In contrast, among women without depression, blame was the only unique risk factor of SI (OR = 2.386).

4. Discussion

Using the EPDS-based definition of postpartum depression, we found that the prevalence of SI in women with and without postpartum depression was 51.8 % and 3.3 %, respectively. That is, about one in two women with postpartum depression and about one in thirty women

Table 1

Subjects' characteristics based on the presence of postpartum depression and suicidal ideation.

	Depression present (EPDS $\geq$ 9, n = 1378)			Depression absent (EPDS<9, n = 4310)		
	No SI (n = 664, 48.2 %)	SI (n = 714, 51.8 %)	p	No SI (n = 4167, 96.7 %)	SI (n = 143, 3.3 %)	p
Age (years)						
~29	201 (43.3 %)	263 (56.7 %)	0.056	1151 (96.0 %)	48 (4.0 %)	0.037
30–34	271 (51.5 %)	255 (48.5 %)		1733 (97.3 %)	49 (2.7 %)	
35–39	164 (50.3 %)	162 (49.7 %)		1076 (96.1 %)	44 (3.9 %)	
40~	28 (45.2 %)	34 (54.8 %)		207 (99.0 %)	2 (1.0 %)	
Education						
High school or lower	118 (44.5 %)	147 (55.5 %)	0.211	633 (96.1 %)	26 (3.9 %)	0.547
Junior college/vocational school	220 (47.0 %)	248 (53.0 %)		1290 (97.0 %)	40 (3.0 %)	
University or high	326 (50.5 %)	319 (49.5 %)		2244 (96.7 %)	77 (3.3 %)	
Marital status						
Married	657 (48.7 %)	692 (51.3 %)	0.009	4116 (96.7 %)	141 (3.3 %)	0.695
Single	7 (24.1 %)	22 (75.9 %)		51 (96.2 %)	2 (3.8 %)	
Parity						
Multipara	287 (47.8 %)	314 (52.2 %)	0.778	1930 (96.1 %)	79 (3.9 %)	0.035
Primipara	377 (48.5 %)	400 (51.5 %)		2237 (97.2 %)	64 (2.8 %)	
Employment						
Working	159 (42.6 %)	214 (57.4 %)	0.021	846 (95.9 %)	36 (4.1 %)	0.068
Maternity/childcare leave	254 (52.2 %)	233 (47.8 %)		1888 (97.4 %)	51 (2.6 %)	
Unemployed	251 (48.5 %)	267 (51.5 %)		1433 (96.2 %)	56 (3.8 %)	
Partner employment						
Company executive	59 (40.4 %)	87 (59.6 %)	0.026	308 (96.6 %)	11 (3.4 %)	0.840
Self-employed	45 (45.0 %)	55 (55.0 %)		262 (96.7 %)	9 (3.3 %)	
Full-time employee	520 (50.3 %)	514 (49.7 %)		3390 (96.7 %)	117 (3.3 %)	

Table 1 (continued)

	Depression present (EPDS $\geq$ 9, n = 1378)			Depression absent (EPDS<9, n = 4310)		
	No SI (n = 664, 48.2 %)	SI (n = 714, 51.8 %)	p	No SI (n = 4167, 96.7 %)	SI (n = 143, 3.3 %)	p
Contract or part-time employee	21 (50.0 %)	21 (50.0 %)		100 (96.2 %)	4 (3.8 %)	
Unemployed	12 (44.4 %)	15 (55.6 %)		56 (100 %)	0 (0.0 %)	
No partner	7 (24.1 %)	22 (75.9 %)		51 (96.2 %)	2 (3.8 %)	
Family income (million JPY)						
<4	78 (45.6 %)	93 (54.4 %)	0.613	330 (96.2 %)	13 (3.8 %)	0.046
4–6.9	252 (47.8 %)	275 (52.2 %)		1426 (95.8 %)	63 (4.2 %)	
7 and above	241 (50.4 %)	237 (49.6 %)		1765 (97.5 %)	45 (2.5 %)	
Unknown/no response	93 (46.0 %)	109 (54.0 %)		646 (96.7 %)	22 (3.3 %)	
Current physical illness						
No	635 (49.0 %)	660 (51.0 %)	0.013	3966 (96.7 %)	134 (3.3 %)	0.422
Yes	29 (34.9 %)	54 (65.1 %)		201 (95.7 %)	9 (4.3 %)	
History of depressive disorders						
Never	590 (50.3 %)	583 (49.7 %)	<0.001	3944 (96.9 %)	126 (3.1 %)	0.003
Ever ^a	60 (43.8 %)	77 (56.2 %)		205 (92.8 %)	16 (7.2 %)	
Recent ^b	14 (20.6 %)	54 (79.4 %)		18 (94.7 %)	1 (5.3 %)	
History of psychiatric disorders (other than depressive disorders)						
Never	603 (49.8 %)	609 (50.2 %)	0.005	3981 (96.9 %)	128 (3.1 %)	0.003
Ever	37 (39.8 %)	56 (60.2 %)		151 (92.1 %)	13 (7.9 %)	
Recent	24 (32.9 %)	49 (67.1 %)		35 (94.6 %)	2 (5.4 %)	
Alcohol drinking						
No	526 (48.9 %)	549 (51.1 %)	0.298	3195 (96.9 %)	102 (3.1 %)	0.138
Yes	138 (45.5 %)	165 (54.5 %)		972 (96.0 %)	41 (4.0 %)	
Smoking						
No	631 (48.7 %)	664 (51.3 %)	0.113	4007 (96.7 %)	135 (3.3 %)	0.286

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Table 1 (continued)

	Depression present (EPDS $\geq$ 9, n = 1378)			Depression absent (EPDS<9, n = 4310)		
	No SI (n = 664, 48.2 %)	SI (n = 714, 51.8 %)	p	No SI (n = 4167, 96.7 %)	SI (n = 143, 3.3 %)	p
Yes	33 (39.8 %)	50 (60.2 %)		160 (95.2 %)	8 (4.8 %)	
Pregnancy complication						
No	421 (48.2 %)	452 (51.8 %)	0.970	2799 (96.8 %)	93 (3.2 %)	0.593
Yes	243 (48.1 %)	262 (51.9 %)		1368 (96.5 %)	50 (3.5 %)	
Infectious disease other than colds during pregnancy						
No	639 (48.1 %)	689 (51.9 %)	0.794	4072 (96.8 %)	134 (3.2 %)	0.007
Yes	25 (50.0 %)	25 (50.0 %)		95 (91.3 %)	9 (8.7 %)	
Childhood adverse experience						
No	281 (50.6 %)	274 (49.4 %)	0.136	2296 (97.2 %)	65 (2.8 %)	0.023
Yes	383 (46.5 %)	440 (53.5 %)		65 (2.8 %)	78 (4.0 %)	
Family support						
Low (0–10)	243 (38.2 %)	393 (61.8 %)	<0.001	750 (92.9 %)	57 (7.1 %)	<0.001
Medium (11–14)	245 (56.6 %)	188 (43.4 %)		1360 (96.9 %)	44 (3.1 %)	
High (15)	176 (57.0 %)	133 (43.0 %)		2057 (98.0 %)	42 (2.0 %)	
Intimate partner violence						
No	555 (50.2 %)	551 (49.8 %)	0.002	3830 (97.0 %)	120 (3.0 %)	0.002
Yes	102 (42.0 %)	141 (58.0 %)		286 (93.2 %)	21 (6.8 %)	
No partner	7 (24.1 %)	22 (75.9 %)		51 (96.2 %)	2 (3.8 %)	
Loneliness increased after the outbreak of COVID-19						
Not at all	136 (50.2 %)	135 (49.8 %)	0.044	2037 (97.6 %)	50 (2.4 %)	0.002
A little	139 (47.8 %)	152 (52.2 %)		245 (95.7 %)	11 (4.3 %)	
Sometimes	134 (45.3 %)	162 (54.7 %)		456 (97.6 %)	11 (2.4 %)	
Mostly	126 (43.4 %)	164 (56.6 %)		641 (95.4 %)	31 (4.6 %)	
Always	129 (56.1 %)	101 (43.9 %)		788 (95.2 %)	40 (4.8 %)	

Table 1 (continued)

	Depression present (EPDS $\geq$ 9, n = 1378)			Depression absent (EPDS<9, n = 4310)		
	No SI (n = 664, 48.2 %)	SI (n = 714, 51.8 %)	p	No SI (n = 4167, 96.7 %)	SI (n = 143, 3.3 %)	p
Mode of childbirth						
Vaginal delivery	531 (48.1 %)	572 (51.9 %)	0.221	3373 (96.8 %)	113 (3.2 %)	0.670
Emergency caesarean section	61 (43.3 %)	80 (56.7 %)		339 (96.9 %)	11 (3.1 %)	
Planned caesarean section	72 (53.7 %)	62 (46.3 %)		455 (96.0 %)	19 (4.0 %)	
Preterm birth (<37 weeks)						
No	616 (48.4 %)	656 (51.6 %)	0.534	3945 (95.3 %)	132 (3.2 %)	0.219
Yes	48 (45.3 %)	58 (54.7 %)		222 (95.3 %)	11 (4.7 %)	
Low birth weight (<2500 g)						
No	592 (48.1 %)	639 (51.9 %)	0.839	3816 (96.7 %)	132 (3.3 %)	0.757
Yes	72 (49.0 %)	75 (51.0 %)		351 (97.0 %)	11 (3.0 %)	
Postpartum period						
0–3 months	89 (54.6 %)	74 (45.4 %)	0.346	693 (97.3 %)	19 (2.7 %)	0.217
4–6 months	92 (49.5 %)	94 (50.5 %)		749 (97.1 %)	22 (2.9 %)	
7–12 months	247 (48.4 %)	263 (51.6 %)		1486 (96.8 %)	49 (3.2 %)	
13–18 months	145 (44.9 %)	178 (55.1 %)		813 (95.4 %)	39 (4.6 %)	
19–31 months	91 (46.4 %)	105 (53.6 %)		426 (96.8 %)	14 (3.2 %)	
Breastfeeding						
No breastfeeding or terminated within 1 month after delivery	51 (39.8 %)	77 (60.2 %)	0.076	351 (98.0 %)	7 (2.0 %)	0.308
Terminated 2–6 month	117 (45.0 %)	143 (55.0 %)		569 (96.0 %)	24 (4.0 %)	
Terminated 7–12 month	83 (46.6 %)	95 (53.4 %)		563 (97.2 %)	16 (2.8 %)	
Terminated 12 ~ month	66 (46.5 %)	76 (53.5 %)		328 (95.6 %)	15 (4.4 %)	
Still breastfeeding now	347 (51.8 %)	323 (48.2 %)		2356 (96.7 %)	81 (3.3 %)	
Gave up hometown delivery						

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Table 1 (continued)

	Depression present (EPDS $\geq$ 9, n = 1378)			Depression absent (EPDS<9, n = 4310)		
	No SI (n = 664, 48.2 %)	SI (n = 714, 51.8 %)	p	No SI (n = 4167, 96.7 %)	SI (n = 143, 3.3 %)	p
No	60 (43.8 %)	77 (56.2 %)	0.417	318 (97.2 %)	9 (2.8 %)	0.378
Yes	196 (50.3 %)	194 (49.7 %)		1293 (96.1 %)	52 (3.9 %)	
No plan of hometown delivery	408 (47.9 %)	443 (52.1 %)		2556 (96.95 %)	82 (3.1 %)	
Cancellation of family members' visits to support during the 1st month after delivery						
No	532 (50.6 %)	520 (49.4 %)	0.001	3401 (96.6 %)	121 (3.4 %)	0.362
Yes	132 (40.5 %)	194 (59.5 %)		766 (97.2 %)	22 (2.8 %)	
Unable to ask advice of doctors or midwives about health after delivery despite needs						
No	518 (50.2 %)	513 (49.8 %)	0.008	3764 (96.7 %)	130 (3.3 %)	0.817
Yes	146 (42.1 %)	201 (57.9 %)		403 (96.9 %)	13 (3.1 %)	
Unable to ask advice of friends about breastfeeding or childcare after delivery despite needs						
No	344 (47.7 %)	377 (52.3 %)	0.712	2840 (96.7 %)	97 (3.3 %)	0.935
Yes	320 (48.7 %)	337 (51.3 %)		1327 (96.6 %)	46 (3.4 %)	

^a Ever: has ever been diagnosed as having a depressive disorder and already achieved remission.

^b Recent: has recently been diagnosed as having a depressive disorder.

without postpartum depression had SI. The prevalence of SI was about 16-fold high in women with postpartum depression compared to in those without postpartum depression. Nevertheless, although with a low prevalence, SI does occur in women without postpartum depression, which calls for in-depth investigation of the risk factors and mechanisms of SI in these women.

By analyzing data of women with and without postpartum depression separately, we further identified common and distinct risk factors of SI for each group. It is worth mentioning that the risk factors that we identified have been largely confirmed in previous studies (Orsolini et al., 2016; Bright et al., 2022; Reid et al., 2022; Tsuno et al., 2022). However, for the first time, we were able to identify risk factors of SI in postpartum depression as well as in the absence of postpartum depression, respectively. Whereas history of depressive disorders (recent) is a risk factor of SI in women with postpartum depression, history of psychiatric disorders other than depressive disorders (ever) is a risk factor of SI in women without postpartum depression. Furthermore, social factors indicating a lack of practical support and greater child-rearing stress, including being single, currently working, family members' visits to support being cancelled, are risk factors of SI in women with postpartum depression. In contrast, individual factors that cause greater psychological stress and/or self-blame, including primipara or first-time motherhood, infectious disease other than colds during pregnancy, feeling of loneliness increased since COVID-19, are risk factors of SI in

Table 2

Associations of subjects' characteristics with suicidal ideation: odds ratios and 95 % CI from logistic regression.

	Depression present (EPDS $\geq$ 9)	Depression absent (EPDS<9)
Age (years)		
~29	Reference	Reference
30–34	0.699 (0.534, 0.914)**	0.619 (0.405, 0.946)*
35–39	0.699 (0.513, 0.952)*	0.862 (0.552, 1.347)
40~	0.746 (0.422, 1.319)	0.188 (0.044, 0.800)*
Marital status		
Married	Reference	Reference
Single	2.861 (1.149, 7.121)*	0.773 (0.170, 3.507)
Parity		
Multipara	Reference	Reference
Primipara	1.040 (0.824, 1.311)	1.476 (1.031, 2.112)*
Employment		
Working	Reference	Reference
Maternity/childcare leave	0.786 (0.586, 1.056)	0.826 (0.526, 1.297)
Unemployed	0.699 (0.524, 0.932)*	0.649 (0.413, 1.019)
Partner employment		
Company executive	1.442 (0.995, 2.091)	0.950 (0.495, 1.826)
Self-employed	1.133 (0.733, 1.751)	0.918 (0.448, 1.881)
Full-time employee	Reference	Reference
Contract or part-time employee	0.809 (0.423, 1.546)	1.019 (0.356, 2.917)
Unemployed	1.325 (0.593, 2.962)	–
No partner	–	–
Family income (million JPY)		
<4	0.866 (0.596, 1.259)	0.778 (0.404, 1.499)
4–6.9	Reference	Reference
7 and above	0.967 (0.736, 1.270)	0.686 (0.453, 1.038)
Unknown/no response	1.059 (0.748, 1.499)	0.808 (0.484, 1.350)
Current physical illness		
No	Reference	Reference
Yes	1.623 (0.990, 2.658)	1.243 (0.608, 2.539)
History of depressive disorders		
Never	Reference	Reference
Ever	1.180 (0.804, 1.732)	1.730 (0.935, 3.203)
Recent	3.809 (1.895, 7.657)***	1.094 (0.127, 9.394)
History of psychiatric disorders (other than depressive disorders)		
Never	Reference	Reference
Ever	1.304 (0.819, 2.076)	2.545 (1.305, 4.962)**
Recent	0.931 (0.504, 1.719)	1.357 (0.298, 6.178)
Infectious disease other than colds during pregnancy		
No	Reference	Reference
Yes	0.826 (0.455, 1.499)	2.874 (1.381, 5.981)**
Childhood adverse experience		
No	Reference	Reference
Yes	0.932 (0.736, 1.179)	1.059 (0.739, 1.517)
Family support		
Low (0–10)	1.850 (1.382, 2.475)***	3.512 (2.274, 5.424)***
Medium (11–14)	0.945 (0.697, 1.281)	1.452 (0.938, 2.249)
High (15)	Reference	Reference
Intimate partner violence		
No	Reference	Reference
Yes	1.153 (0.851, 1.561)	1.576 (0.946, 2.627)
No partner	–	–

(continued on next page)

Table 2 (continued)

	Depression present (EPDS≥9)	Depression absent (EPDS<9)
Loneliness increased after the outbreak of COVID-19		
Not at all	Reference	Reference
A little	0.943 (0.656, 1.356)	1.379 (0.680, 2.800)
Sometimes	1.156 (0.814, 1.642)	0.930 (0.471, 1.835)
Mostly	1.289 (0.908, 1.830)	1.754 (1.089, 2.826)*
Always	0.834 (0.576, 1.208)	2.026 (1.309, 3.134)**
Cancellation of family members' visits to support during the 1st month after delivery		
No	Reference	Reference
Yes	1.350 (1.026, 1.777)*	0.679 (0.421, 1.096)
Unable to ask advice of doctors or midwives about health after delivery despite needs		
No	Reference	Reference
Yes	1.249 (0.950, 1.643)	0.728 (0.394, 1.343)

* $p < 0.05$.** $p < 0.01$.*** $p < 0.001$.

Table 3

Associations of each depressive symptom with suicidal ideation: odds ratios and 95 % CI from logistic regression.

	Depression present (EPDS≥9)	Depression absent (EPDS<9)
EPDS1 lack of enjoyment	1.378 (1.016, 1.868)*	0.884 (0.263, 2.977)
EPDS2 lack of anticipation	1.016 (0.755, 1.367)	0.521 (0.204, 1.330)
EPDS3 blame	1.260 (0.564, 2.814)	2.386 (1.429, 3.985)***
EPDS4 anxiety	0.634 (0.442, 0.909)*	1.042 (0.703, 1.544)
EPDS5 fear	2.035 (1.422, 2.912)***	1.439 (0.982, 2.109)
EPDS6 difficulty coping	0.548 (0.259, 1.160)	1.637 (0.905, 2.962)
EPDS7 insomnia	1.347 (1.013, 1.791)*	1.444 (0.981, 2.124)
EPDS8 sadness	1.753 (1.010, 3.041)*	2.985 (1.983, 4.491)***
EPDS9 tears	3.379 (2.635, 4.333)***	1.788 (1.085, 2.945)*

* $p < 0.05$.** $p < 0.01$.*** $p < 0.001$.

women without postpartum depression. This speculation is consistent with our finding on individual depressive symptoms that the presence of blame (i.e., “Blamed myself unnecessarily for things”) is a unique risk factor of SI in women without postpartum depression.

Although a strong link between depression and SI has been established decades ago, the precise mechanism of such a link is unknown. It has been proposed that depression exacerbates vulnerabilities or maladaptive psychological functioning, which increases the likelihood of SI (Nock et al., 2014). It is also possible that both depression and SI are linked to a third factor, such as hopelessness, which leads to SI (Nock et al., 2014). Building upon previous findings, our study indicates that social factors that cause greater child-rearing stress and a lack of practical support from parents or other family members increase the risk of SI in postpartum depression.

In women without postpartum depression, history of psychiatric disease other than depressive disorders and individual factors that cause greater psychological stress and/or self-blame are risk factors of SI. We were not able to specify what kind of psychiatric disease here. Previous studies have reported that psychiatric disorders such as anxiety disorder, post-traumatic stress disorder, and substance abuse disorder increase the risk of SI in the perinatal period (Orsolini et al., 2016; Bright et al., 2022). A link between psychological stress and SI has also been established. It has been proposed that when people experience unbearable psychological pain, the thought of suicide may occur as a means to escape (Nock et al., 2014). One such unbearable psychological pain may

come from being diagnosed with an infectious disease such as sexually transmitted infection (Peltzer, 2015; Rodriguez et al., 2017), which explains our finding that infectious disease other than colds during pregnancy is a risk factor of SI in the absence of postpartum depression.

Our findings have important clinical implications for the early detection of SI among postpartum women. Regardless of the presence or absence of postpartum depression, certain factors, such as young age, low family support, and the presence of sadness and tears are common risk factors of SI. By recognizing and attending to these universal risk elements, healthcare providers may streamline the preliminary screening for SI. Moreover, there are divergent risks to consider. For women with postpartum depression, SI is more strongly associated with recent diagnoses of depressive disorders, being single, current employment, cancelled familial support visits following childbirth, and symptoms such as fear, lack of enjoyment (or anhedonia), and insomnia. Conversely, for women without depression, the specific risk factors for SI include a history of infections other than common colds during pregnancy, feelings of loneliness exacerbated by the COVID-19 pandemic, first-time motherhood (primipara), and tendencies to self-blame. Implementing this nuanced, two-tiered screening approach can enhance the early and precise identification of SI.

Nevertheless, our study has several limitations. Firstly, the reliance on self-reported measures for both SI and risk factors might introduce biases linked to memory and social expectations. Although the 10th item of the EPDS is the most common tool for screening SI in postpartum women, it is not without its limitations (Chen et al., 2023a) and future research should use more sensitive and specific diagnostic interviews to capture SI more accurately. Secondly, while we used the most common definition of SI based on any affirmative response to the 10th item of the EPDS (Chen et al., 2023b), only the response “yes, quite often” may indicate a high intent of SI and suicidal behaviors (Howard et al., 2011). Even with our substantial nationwide survey of 5688 subjects, a mere 124 reported SI at the frequency of “yes, quite often” in those with depression, with no reports from those without depression. Future research must utilize larger datasets, ideally exceeding 10,000 subjects, to unravel the risk factors associated with high-intent SI. Thirdly, the cross-sectional nature of our study necessitates further longitudinal and interventional research to elucidate the causal relationships between the identified risk factors and SI.

Despite these drawbacks, our study possesses significant strengths, such as the inclusion of a large, age- and geographically-diverse national survey dataset, and an exhaustive examination of sociodemographic variables and SI risk factors. Taken together, our findings suggest distinct psychopathological mechanisms underlying SI in women with and without postpartum depression. These findings may enhance our understanding of the mechanism of SI and call for tailored SI intervention strategies according to whether postpartum depression is present or not.

Role of the funding source

The findings and conclusions of this article are the sole responsibility of the authors and do not represent the official views of the research funders.

Funding

This study was supported by the Japan Society for the Promotion of Science KAKENHI Grants [grant numbers JP 21H04856]; the Japan Science and Technology Agency [grant number JPMJSC21U6]; Intramural fund of the National Institute for Environmental Studies; Innovative Research Program on Suicide Countermeasures [grant number: R3-2-2]; and Ready for COVID-19 Relief Fund [grant number: 5th period 2nd term 001]. The findings and conclusions of this article are the sole responsibility of the authors and do not represent the official views of the research funders.

CRediT authorship contribution statement

Conceptualization and design: C.C., R.O., T.T.; Investigation: R.O., S.O., T.T.; Data analysis and manuscript preparation: C.C.; Manuscript revision: all authors.

Declaration of competing interest

The authors report no conflict of interest.

Acknowledgements

This study was supported by the Japan Society for the Promotion of Science KAKENHI Grants [grant numbers JP 21H04856]; the Japan Science and Technology Agency [grant number JPMJSC21U6]; Intramural fund of the National Institute for Environmental Studies; Innovative Research Program on Suicide Countermeasures [grant number: R3-2-2]; and Ready for COVID-19 Relief Fund [grant number: 5th period 2nd term 001].

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