

# Relationship between the mode of conception and depressive symptoms during the first 6 months post-partum in Japan

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## Abstract

**Purpose:** To determine whether conventional treatment and assisted reproductive technology for infertility are associated with depressive symptoms and to identify the predictors of depressive symptoms during the first 6 months' post-partum.

**Methods:** A prospective cohort design was used, with the participants being recruited from 13 Japanese hospitals. Using self-report questionnaires, a total of 2709 women (response rate: 71.9%) provided longitudinal data at five time points: during their hospital stay and at 1, 2, 4, and 6 months' post-partum. The depressive symptoms were measured by using the Japanese version of the Edinburgh Postnatal Depression Scale (EPDS). A logistic regression analysis was used to examine the association between the mode of conception and depressive symptoms and to identify the predictors of the depressive symptoms.

**Results:** There was no significant association between the mode of conception and the depressive symptoms at any time point. Six factors that were associated with the EPDS score were first-time childbirth, emergency cesarean delivery, infant feeding, financial burden, having a male infant, and dissatisfaction with social support.

**Conclusion:** There was no significant relationship between the mode of conception and depressive symptoms. Nursing care should be based on individual assessments that focus on parity, the delivery method, infant feeding method, financial burden, the infant's sex, and social support, rather than on the mode of conception.

## KEYWORDS

depression, in vitro fertilization, infertility, mothers, post-partum

## 1 | INTRODUCTION

An increasing number of women are becoming mothers by seeking treatment for infertility. In particular, the number of births that were achieved through assisted reproductive technology (ART) increased from 1 in 56 of all live-born infants in 2005 to 1 in 25 live-born infants in 2013.<sup>1</sup>

There have been reports of adverse effects on the psychological health of women who receive ART infertility treatment, including

a high state of anxiety and a tendency to develop depression.<sup>2,3</sup> However, a meta-analysis of 14 prospective studies of infertile women concluded that neither anxiety nor depression affects the ART fertility rate.<sup>4</sup> With respect to the parental role, women who conceive by using in vitro fertilization (IVF) report lower levels of self-esteem and parenting competence than first-time mothers with no history of infertility.<sup>5</sup> Additionally, a systematic review suggested that subgroups of women who undergo ART procedures are more vulnerable than others to psychological difficulties during the

transition to parenthood.<sup>6</sup> However, a study comparing women who conceived after infertility treatment with those who conceived naturally found that there was no difference in their adaptability to the maternal role in the perinatal period.<sup>7</sup>

A Japanese study reported that primiparous women who had received conventional infertility treatment (clomiphene, hormone injections, or artificial insemination) had slightly higher scores on the Edinburgh Postnatal Depression Scale (EPDS) than women who had received ART treatment at all three time points studied (late pregnancy, after the first week post-partum, and at 1 month post-partum).<sup>8</sup> However, the number of participants in that study was limited and there was no significant difference among the three different studied modes of conception (conventional infertility treatment, ART infertility treatment, and natural conception).<sup>8</sup> Consistent with that finding, in another study, the women who had conceived through ART showed no increased risk of postnatal depression, compared with those who had conceived naturally.<sup>9</sup> A population-based sample of women in the USA who had conceived following any infertility treatment also had no increased risk of post-partum depressive symptoms.<sup>10</sup> In contrast, an Italian study found that the number of ART cycles, but not the number of conventional infertility treatments, was a factor that predicted the post-partum psychological state.<sup>11</sup>

Primiparous women who conceive after ART are generally older than women who conceive naturally; however, both older and younger primiparae have been reported to have a higher risk of post-partum depression than multiparous mothers during the first month post-partum.<sup>12</sup> In a study of primiparous women who had conceived naturally or after ART, structured interviews at 4 months' post-partum revealed no difference in the rate of major depressive disorder by conception method across the three age groups.<sup>13</sup> However, those results were from research that was conducted in Western countries, where egg donation is legally permitted. In addition, that study did not consider social support as a protective factor for postnatal depression and did not distinguish between women who had conceived through conventional infertility treatment and those who had conceived after ART.

To summarize the previous studies, the effects of infertility treatment on the psychological health of post-partum women are not consistent and most of the studies were conducted in limited time periods. Furthermore, the Japanese cultural context should be considered in applying the results of those studies. In Japan, egg donation for ART is regulated by scientific societies and the postnatal hospital stay is longer than in countries like Australia and the USA. Japan also has a social support custom called *satogaeri*, where new mothers return to their parents' home after discharge from the birthing facility to receive help from their own mother in the first post-partum month. This cultural practice means that the results of previous research from Western countries cannot necessarily be applied in Japan. Little longitudinal research is available on the association between the mode of conception and postnatal depression in Japanese mothers spanning the first 6 months' post-partum, which is a high-risk period for depression.<sup>14</sup> Therefore, this study aimed to

clarify the relationship between the mode of conception (conventional or ART infertility treatment) and depressive symptoms and to identify the predictors of depressive symptoms during the first 6 months after childbirth.

## 2 | PARTICIPANTS AND METHODS

The study's sample was taken from a prospective cohort study that examined the physical and psychosocial well-being of Japanese mothers during the first 6 months' post-partum. A detailed description of the cohort study method has been published previously.<sup>15,16</sup> Approval of the cohort study was obtained from the relevant review boards at the principal investigator's university and participating research hospitals.

The study's participants were Japanese female patients at 13 hospital obstetric wards in the cities of eastern and western Japan between May, 2012 and September, 2013. The eligibility requirements were those who were aged 16 years or older and a singleton delivery. The exclusion criteria were difficulty communicating in the Japanese language and any postnatal condition that was life-threatening or distressing, in either the mother or the newborn.

### 2.1 | Procedure

Women were recruited during days 1-3 of their hospital stay after delivery by using a brochure that explained the study. The information that was provided included the aim of the cohort study spanning 6 post-partum months, the participation method, the voluntary nature of participation, and the right of the participants to withdraw at any time. Each woman was given the opportunity to participate and asked to sign a consent form. On the day before hospital discharge, the women who had consented to participate completed a self-report questionnaire that included questions about their demographic and obstetric information, as well as the 10 item EPDS. Medical facilities that cooperated in this research used a mother-infant, shared-room system. Generally, the women were hospitalized for 4-6 days following vaginal delivery and 6-9 days after a cesarean delivery. Another self-report questionnaire that incorporated the EPDS was administered at 1, 2, 4, and 6 months' post-partum.

### 2.2 | Post-partum depression

The post-partum depressive symptoms were assessed with the EPDS, which was created to screen for post-partum depression.<sup>17</sup> The EPDS is a valid tool for new mothers and has high sensitivity and specificity.<sup>18</sup> A valid and reliable Japanese version of the EPDS is available<sup>19</sup> and has been used previously to identify post-partum depression among new mothers in Japan. The Japanese EPDS is a 10 item self-report questionnaire that is used to assess the existence and degree of depressive symptoms. Each item is scored on a scale of 0-3, giving a total score of 0-30. A score of 9 is the recommended

threshold to determine whether depressive symptoms merit clinical consideration.<sup>19</sup> Thus, a high risk of post-partum depression was defined as having a Japanese EPDS score of at least 9.

### 2.3 | Demographic and obstetric information

The participants' age was their age on their last birthday at the time of delivery. Information was obtained from the hospital records and included the participants' obstetric history, previous births and modes of conception, maternal health during pregnancy, delivery, and the postnatal period, and newborn medical data. The self-report questionnaire during hospitalization queried information about childbirth preparation, satisfaction with childbirth, and demographic information that included the academic background, marital history, economic status, and family composition. The questionnaire also covered features of domestic life, such as post-partum physical discomfort, infant feeding, hours of sleep, satisfaction with social support, and perceived difficulty in daily life. This second group of questions was repeated in the questionnaires at 1, 2, 4, and 6 months' post-partum.

### 2.4 | Data analysis

The participating women were assigned to three groups, according to the mode of conception: natural conception, conventional infertility treatment, and ART groups. The conventional infertility treatment group included women who had conceived by using clomiphene, hormone injections, or artificial insemination. The ART group included women who had conceived through ART, IVF-embryo transfer, or intracytoplasmic sperm injection.

An ANOVA was performed to compare the means of age, followed by post hoc tests using the Bonferroni procedure. To investigate the relationship between the mode of conception and post-partum depressive symptoms and to identify the predictors of depressive symptoms, a logistic regression analysis was conducted, using the absence or presence of an EPDS score of  $\geq 9$  as a dependent variable and 14 explanatory variables, plus the variable mode of conception as an independent variable. The statistical analyses were conducted by using IBM SPSS v. 21 (IBM Corporation, Armonk, NY, USA), with the significance level set at  $P \leq .05$ .

In order to exclude the impact of other possible risk factors for post-partum depression, 14 control variables were included: age at delivery (30 years or younger [reference], 31-36 years, or 37 years or older); education (junior high/high school graduate [reference], vocational school/junior college graduate, or university/graduate school graduate); parity (multipara [reference] or primipara); type of delivery (vaginal delivery [reference], planned or emergency cesarean delivery); sex of infant (female [reference] or male); birthweight (continuous variable); gestation at delivery (full-term [reference] or preterm birth); infant feeding method (exclusive breast-feeding [reference], mixed feeding [primarily breast milk], mixed feeding [primarily formula], or exclusive formula feeding); perceived financial burden (absence [reference] or presence);

number of spontaneous abortions or stillbirths (continuous variable); and satisfaction with four types of social support: instrumental, informational, appraisal, and emotional support (very satisfied [reference], somewhat satisfied, somewhat dissatisfied, or very dissatisfied). These variables were chosen because they were considered to be important clinically, based on the findings of previous studies,<sup>20-23</sup> to elucidate the independent association of the mode of conception with depressive symptoms. The authors added the variable mode of conception (natural conception, conventional infertility treatment, or ART), giving a total of 15 variables that were included simultaneously in the regression model using forced entry. As the four social support variables were not measured before hospital discharge, they were excluded from the analysis of the postnatal hospital stay data.

## 3 | RESULTS

Of the 3769 women who had agreed to participate, 2709 women provided complete information in the self-report questionnaires at all five time points: during their hospital stay and 1, 2, 4, and 6 months' post-partum (response rate: 71.9%). The mean age of the participants was 33.0 years (range: 17-48 years), while 1464 (54.0%) were primiparous and 1245 (46.0%) were multiparous. Regarding the three different modes of conception, there were 2352 (86.8%) mothers in the natural conception group, 162 (6.0%) in the conventional infertility treatment group, and 189 (7.0%) in the ART group (Table 1). A total of 452 (16.7%) mothers had high EPDS scores ( $\geq 9$ ) during their postnatal hospital stay: 374 (15.9%) in the natural conception group, 36 (22.2%) in the conventional infertility treatment group, and 42 (22.2%) in the ART group ( $\chi^2 = 8.76$ ,  $P = .013$ ). There were 411 (15.2%) women with high EPDS scores at 1 month post-partum, 260 (9.6%) at 2 months' post-partum, 221 (8.2%) at 4 months' post-partum, and 241 (8.9%) at 6 months' post-partum. There was no significant difference in the presence of high EPDS scores at 1, 2, 4, and 6 months' post-partum among the three groups by mode of conception (Table 2).

Only the significant results were shown, which were for eight variables plus the variable mode of conception, as shown in Table 3. This table shows all the odds ratios, including those with a value of 1, and values for the 95% confidence intervals to the second decimal place. The logistic regression analysis results did not show a significant relationship between the mode of conception and depressive symptoms at any time from the postnatal hospital stay to 6 months' post-partum. During the postnatal hospital stay, the factors that were related to the EPDS score were financial burden, infant feeding method, first-time childbirth, and emergency cesarean delivery (Table 3). The five factors that were associated with the EPDS score at 1, 2, 4, and 6 months' post-partum were first-time childbirth and having a male infant (at both 1 and 2 months' post-partum only), financial burden, mixed feeding or formula feeding, and dissatisfaction with social support (Table 3).

**TABLE 1** Participants' demographic and background characteristics by mode of conception

Variable	Total <sup>a</sup> (n = 2709) N (%)	Natural conception (n = 2352) N (%)	Conventional infertility treatment (n = 162) N (%)	Assisted reproductive technology (n = 189) N (%)	Group comparisons and P-values of the chi-square tests
Age (y): mean (SD)	33 (4.8)	33 (4.6)	34 (4.1)	38 (3.7)	<.001 <sup>b</sup>
<b>Parity</b>					
Primipara	1464 (54.0)	1201 (51.1)	114 (70.4)	144 (76.2)	<.001
Multipara	1245 (46.0)	1151 (48.9)	48 (29.6)	45 (23.8)	
<b>Marital status</b>					
Married	2654 (98.0)	2298 (97.7)	162 (100.0)	188 (99.5)	.031 <sup>c</sup>
Single	55 (2.0)	54 (2.3)	0 (0.0)	1 (0.5)	
<b>Employment</b>					
Employed	1258 (46.4)	1079 (45.9)	78 (48.1)	99 (52.4)	.207
Not employed	1450 (53.5)	1272 (54.1)	84 (51.9)	90 (47.6)	
Missing	1 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	
<b>Financial burden</b>					
Yes	1225 (45.2)	1094 (46.5)	68 (42.0)	61 (32.3)	.001
No	1478 (54.6)	1253 (53.3)	93 (57.4)	128 (67.7)	
Missing	6 (0.2)	5 (0.2)	1 (0.6)	0 (0.0)	
<b>Education</b>					
Junior/high school	508 (18.8)	465 (19.8)	24 (14.8)	19 (10.1)	.006
Vocational school/ junior college	972 (35.9)	823 (35.0)	65 (40.1)	82 (43.4)	
College/graduate school	1226 (45.3)	1062 (45.2)	72 (44.4)	88 (46.6)	
Missing	3 (0.1)	2 (0.1)	1 (0.6)	0 (0.0)	
<b>Gestation</b>					
Preterm	76 (2.8)	63 (2.7)	4 (2.5)	9 (4.8)	.243 <sup>c</sup>
Term	2630 (97.1)	2286 (97.2)	158 (97.5)	180 (95.2)	
Missing	3 (0.1)	3 (0.1)	0 (0.0)	0 (0.0)	
<b>Type of delivery</b>					
Vaginal	2252 (83.1)	1993 (84.7)	129 (79.6)	126 (66.7)	<.001
Planned CD	291 (10.7)	241 (10.2)	12 (7.4)	36 (19.0)	
Emergency CD	165 (6.1)	117 (5.0)	21 (13.0)	27 (14.3)	
Missing	1 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	
<b>Sex of infant</b>					
Male	1401 (51.7)	1207 (51.3)	97 (59.9)	93 (49.2)	.084
Female	1308 (48.3)	1145 (48.7)	65 (40.1)	96 (50.8)	

CD, cesarean delivery; SD, standard deviation.

<sup>a</sup>Six participants had missing data for their type of conception.

<sup>b</sup>ANOVA was performed to compare the means of age, followed by post hoc tests using the Bonferroni procedure.

<sup>c</sup>Fisher's exact test.

## 4 | DISCUSSION

This study showed that during the postnatal hospital stay, the three different modes of conception were significantly associated with the presence of self-reported depressive symptoms. However, when the risk factors for postnatal depressive symptoms were controlled

for in the multivariable regression model, there was no link between the mode of conception and depressive symptoms throughout the first 6 months' post-partum, including during the postnatal hospital stay. This result supports that of previous research that showed no difference in the prevalence of post-partum depression at 1 month or 3-4 months' post-partum in women who had conceived either

**TABLE 2** Prevalence of depressive symptoms (Edinburgh Postnatal Depression Scale score  $\geq 9$ ) over time among the post-partum women by the mode of conception

	Total (n = 2709) N (%)	Natural conception (n = 2352) N (%)	Conventional infertility treatment (n = 162) N (%)	Assisted reproduc- tive technology (n = 189) N (%)	Group comparisons and P-values of the chi-square tests
At hospital	452 (16.7)	374 (15.9)	36 (22.2)	42 (22.2)	.013
1 month post-partum	411 (15.2)	356 (15.1)	22 (13.6)	33 (17.5)	.581
2 months' post-partum	260 (9.6)	225 (9.6)	18 (11.1)	17 (9.0)	.776
4 months' post-partum	221 (8.2)	192 (8.2)	13 (8.0)	16 (8.5)	.987
6 months' post-partum	241 (8.9)	209 (8.9)	15 (9.3)	17 (9.0)	.986

naturally or through ART.<sup>9,10</sup> In addition, this study used a sufficient sample size and controlled for 14 variables that were identified in previous Japanese studies as predictive factors for post-partum depression.<sup>20,21</sup> These findings thus clarify that the method of conception and, in particular, the use of conventional infertility treatment and ART are not predictive factors for post-partum depressive symptoms in the first 6 months after childbirth.

It was found that four factors had a significant relationship with post-partum depressive symptoms during the hospital stay: emergency cesarean delivery, first-time childbirth, exclusive breastfeeding, and perceived financial burden. The latter three remained significantly associated factors after leaving hospital, along with two additional factors: having a son and dissatisfaction with social support. These observations are consistent with research results that were available to date on primiparae who experienced stress when first adapting to the maternal role and indicates that being a first-time mother could be a trigger for post-partum depressive symptoms. As becoming a mother for the first time was a factor that was related to post-partum depression for  $\leq 2$  months' post-partum, preventive care for post-partum depression is needed before childbirth for primiparae.

Requiring an emergency cesarean delivery was a factor that was related to post-partum depressive symptoms only during the post-partum hospital stay. An emergency cesarean delivery is an unexpected critical event that has been reported to be a traumatic experience for women<sup>22</sup>; as such, it is conceivably linked to early post-partum depressive symptoms. Given that undergoing an emergency cesarean delivery was not related to post-partum depressive symptoms after 1 month post-partum, it may be considered a risk factor that should be noted in the early post-partum period.

Most mothers in this study desired to breast-feed their infants. There was no major issue for the mothers or infants who could share a room with their infant while hospitalized. The women received appropriate care and were allowed to try breast-feeding in their own way. It was noted that for some mothers, not being able to exclusively breastfeed their infant despite a desire to do so might have become a discouraging experience that could have influenced

depressive symptoms; this is an issue that could warrant further examination in future studies. As a factor associated with post-partum depressive symptoms, a perception of economic burden correlates with financial distress, as indicated in a previous report.<sup>23</sup> Financial worry might compound the emotional anxiety that is experienced after childbirth and become linked to post-partum depression.

The study's finding of an association between dissatisfaction with social support and post-partum depression is consistent with a general insufficiency of social support.<sup>23,24</sup> Feeling dissatisfied with social support (which functions as a buffer for post-partum stress) indicates either a lack of any social support or a lack of support that meets a mother's needs. Based on this result, social support that fulfills a mother's needs is necessary, not only during the early post-partum period but also  $\leq 6$  months' post-partum.

There is a saying in Japan that "It's good to first have a girl, then a boy," reflecting a belief that girls are easier to raise than boys and it is best to first gain experience raising a girl before having a boy. If mothers expect to have a harder time caring for a boy than a girl, they could feel that male infants are difficult to raise and would prefer to have a girl. A difficult baby also exacerbates a mother's parenting stress.<sup>25</sup> In an age of declining birthrates, where mothers commonly raise only one or two children, this finding that the infant's sex is a predictive factor for post-partum depressive symptoms is consistent with findings from China. In that country, there is a preference for a having a boy first and having a girl first is a risk factor for post-partum depression.<sup>26</sup> The preference for a girl first might be characteristic of Japanese mothers; this is an interesting topic that warrants further investigation to further clarify an influence of male sex on post-partum depression.

An important implication of this research is that, regardless of the mode of conception, an assessment to prevent depressive symptoms during the post-partum hospital stay should consider factors, such as first-time childbirth, emergency cesarean delivery, non-exclusive breastfeeding, and the perception of economic burden. A preventive assessment for post-partum depression also should be carried out at the 1 month infant check-up and should consider whether a mother

**TABLE 3** Associations of the mode of conception and other variables with depression in the first 6 months' post-partum (n = 2709)

Independent variable	Hospital stay OR (95% CI)	1 month post-partum OR (95% CI)	2 months' post-partum OR (95% CI)	4 months' post-partum OR (95% CI)	6 months' post-partum OR (95% CI)
<b>Mode of conception</b>					
Natural conception	1.00	1.00	1.00	1.00	1.00
Conventional infertility treatment	1.23 (0.82-1.85)	0.71 (0.43-1.17)	1.12 (0.64-1.98)	1.02 (0.52-1.97)	0.94 (0.50-1.77)
Assisted reproductive technology	1.17 (0.78-1.76)	0.77 (0.49-1.22)	0.77 (0.42-1.40)	1.05 (0.57-1.94)	0.98 (0.54-1.77)
<b>Financial burden</b>					
Absence	1.00	1.00	1.00	1.00	1.00
Presence	<b>1.89 (1.52-2.35)</b>	<b>2.28 (1.79-2.89)</b>	<b>2.70 (2.00-3.66)</b>	<b>2.21 (1.60-3.07)</b>	<b>2.33 (1.71-3.17)</b>
<b>Infant feeding</b>					
Exclusive breast-feeding	1.00	1.00	1.00	1.00	1.00
Mixed feeding (primarily breast milk)	<b>1.40 (1.07-1.83)</b>	<b>1.52 (1.17-1.97)</b>	<b>1.46 (1.06-2.02)</b>	1.27 (0.86-1.88)	1.09 (0.74-1.59)
Mixed feeding (primarily formula)	<b>1.67 (1.29-2.16)</b>	<b>1.99 (1.43-2.76)</b>	<b>1.96 (1.27-3.03)</b>	1.56 (0.96-2.53)	0.95 (0.56-1.60)
Exclusive formula feeding	<b>2.08 (1.09-3.95)</b>	1.14 (0.51-2.55)	1.84 (0.99-3.44)	<b>1.81 (1.11-2.96)</b>	<b>1.78 (1.18-2.67)</b>
<b>Parity</b>					
Multipara	1.00	1.00	1.00	1.00	1.00
Primipara	<b>2.87 (2.25-3.67)</b>	<b>3.14 (2.40-4.10)</b>	<b>1.49 (1.10-2.02)</b>	1.30 (0.94-1.81)	0.98 (0.72-1.34)
<b>Type of delivery</b>					
Vaginal	1.00	1.00	1.00	1.00	1.00
Planned cesarean section	1.20 (0.83-1.72)	0.85 (0.56-1.29)	0.77 (0.47-1.27)	1.24 (0.75-2.03)	1.19 (0.75-1.89)
Emergency cesarean section	<b>1.76 (1.21-2.55)</b>	0.88 (0.56-1.38)	0.61 (0.32-1.17)	1.17 (0.63-2.16)	1.00 (0.53-1.88)
<b>Sex of infant</b>					
Female	1.00	1.00	1.00	1.00	1.00
Male	1.23 (0.99-1.52)	<b>1.28 (1.01-1.61)</b>	<b>1.66 (1.24-2.21)</b>	1.21 (0.89-1.64)	1.26 (0.94-1.69)
<b>Satisfaction with instrumental support</b>					
Very satisfied		1.00	1.00	1.00	1.00
Somewhat satisfied		<b>1.78 (1.32-2.42)</b>	1.17 (0.76-1.80)	1.49 (0.86-2.59)	<b>1.92 (1.08-3.41)</b>
Somewhat dissatisfied		<b>2.13 (1.32-3.42)</b>	1.71 (0.97-3.02)	1.50 (0.76-2.97)	<b>2.13 (1.07-4.26)</b>
Very dissatisfied		1.65 (0.56-4.85)	<b>3.18 (1.30-7.76)</b>	2.64 (0.93-7.49)	2.62 (1.00-6.89)
<b>Satisfaction with appraisal support</b>					
Very satisfied		1.00	1.00	1.00	1.00
Somewhat satisfied		1.25 (0.81-1.92)	<b>2.04 (1.15-3.94)</b>	1.46 (0.73-2.95)	1.31 (0.57-3.01)
Somewhat dissatisfied		1.54 (0.92-2.58)	<b>2.93 (1.40-6.13)</b>	1.55 (0.68-3.53)	2.16 (0.88-5.28)
Very dissatisfied		<b>2.60 (1.15-5.88)</b>	2.78 (1.00-7.74)	3.35 (0.96-11.70)	1.97 (0.66-5.88)
<b>Satisfaction with emotional support</b>					
Very satisfied		1.00	1.00	1.00	1.00
Somewhat satisfied		1.44 (0.95-2.18)	1.00 (0.56-1.78)	1.60 (0.73-3.51)	1.43 (0.63-3.26)
Somewhat dissatisfied		<b>2.29 (1.35-3.89)</b>	1.75 (0.87-3.49)	<b>6.12 (2.54-14.78)</b>	2.50 (0.99-6.32)
Very dissatisfied		<b>3.30 (1.26-8.61)</b>	1.92 (0.60-6.19)	<b>8.97 (2.54-31.73)</b>	<b>3.72 (1.10-12.53)</b>

CI, confidence interval; OR, odds ratio.

Bold refers to the significant results.



is a primipara, as well as whether she is dissatisfied with the social support and sex of her infant.

This study was limited by the fact that the participants were assigned to three groups based on their mode of conception, but the details of the infertility treatments, such as the cause of infertility and the number of ART cycles, were not considered.<sup>11</sup> In addition, an exclusion criterion of this study was the presence of any mental disorder during pregnancy. It did not include mothers with the presence of any mental disorder during pregnancy; therefore, women with perinatal depression following ART might not have been included in this study. If the presence of any mental disorder during pregnancy had not been an exclusion criterion, this study's results might have differed with respect to the mode of conception. Moreover, because recruitment occurred after childbirth, it is possible that mothers with severe depression during pregnancy following infertility treatment were excluded from the study. However, the merits of this study include the use of a sufficiently large sample (n = 2709) and an analysis of longitudinal data that spanned a 6 month post-partum period.

The results of this study suggest that infertility treatments do not always lead to negative impacts on a woman's post-partum psychological health. Instead, it was found that during the first 6 months after childbirth, financial worry, an inability to exclusively breast-feed, and dissatisfaction with social support were related to post-partum depressive symptoms. To prevent post-partum depression, it is important to periodically conduct individual assessments. An assessment of Japanese mothers during the post-partum hospital stay should consider factors, such as being a first-time mother and having an emergency cesarean delivery; assessments at 1 and 2 months' post-partum should consider being a first-time mother and having a male infant.

In this study, it has been shown that there is no significant relationship between the mode of conception and depressive symptoms during the first 6 months' post-partum in a sample of Japanese mothers. In order to prevent post-partum depression, it is necessary to provide nursing care that is based on individual assessments that are not focused on the mode of conception, but rather on whether the mother is a primipara or multipara, the delivery method, whether the desired infant-feeding method has been achieved, whether a feeling of financial burden exists, the degree of satisfaction with social support, and whether the mother is stressed because of her infant's sex.

Further longitudinal research from early pregnancy following infertility treatment is needed in order to clarify whether there is a relationship between the onset of perinatal depression and not only the mode of conception, but also factors including the cause of infertility and the number of ART cycles.

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## DISCLOSURES

**Conflict of interest:** The authors declare no conflict of interest. **Human Rights Statement and Informed Consent:** The protocol for this research

project, including human participants, was approved by the suitably constituted ethics committee at Chiba University Graduate School of Nursing (No. 23-71, 23-78), Chiba, Japan.

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