

# Postpartum depressive symptoms during the COVID-19 pandemic in Japan: The first quantitative evidence

Midori Matsushima (✉ [matsushima.midori.gb@u.tsukuba.ac.jp](mailto:matsushima.midori.gb@u.tsukuba.ac.jp))

University of Tsukuba, Faculty of Humanities and Social Sciences

Hanna Horiguchi

Kobe University, School of Medicine Faculty of Health Sciences

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## Short Report

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# Abstract

**Purpose:** This study explores postpartum depression during the COVID-19 pandemic in Japan.

**Methods:** An online survey was conducted from May 31 to June 6, 2020 and obtained 2,878 responses from mothers with infants less than 12 months.

**Results:** The point prevalence of the Edinburgh Postnatal Depression Scale score of  $\geq 9$  was 26.96%. Logistic regression analysis indicated a negative association between the COVID-19 pandemic and mental well-being.

**Conclusion:** In particular, our results indicate the importance of social support and economic recovery in ameliorating mental health of mothers in the postpartum period.

## Introduction

Similar to the rest of the world, Japan has been affected by the COVID-19 pandemic, with the first case reported on December 31, 2019. Although COVID-19 related deaths have been relatively on a smaller scale, health and financial uncertainty coupled with social isolation caused by this pandemic is severe.

Postpartum depression (depression during the first year after childbirth) is not uncommon. The percentage of women who suffer from depression is estimated to be around 13% worldwide (O' Hara and Swain 1996), and a Japanese study has also shown a similar percentage [ranging from 8.4% (Yamagata 2015) to 15.2% (Asano et al. 2014)]. Considering that adverse events in life and high perceived stress, as well as a lack of social support, are some of the fundamental risk factors for antenatal depression (Biaggi, Conroy, Pawlby, and Pariante 2016), mental well-being of postpartum women in the present-day COVID-19 pandemic requires a great deal of attention. Despite its importance, no study has hitherto examined postnatal depression and its risk factors related to the COVID-19 pandemic in Japan, and this is the first study to present quantitative evidence to this effect.

## Materials And Methods

We used a cross-sectional study design, and an online survey was conducted from May 31 to June 6, 2020 through two companies (Karada note Inc. and baby calendar Inc.) that provided services to pregnant and postpartum women and mothers with children. We sent emails to all the users soliciting voluntary participation in our survey. Because users of the services of these companies included non-active and non-target groups, we could not calculate the exact percentage of respondents among our targets. We sent 607,458 emails, among which about 1.3% of the participants accessed our survey web page. Among those who accessed our survey web page, approximately 74% replied (5,650 replies). Respondents were from all prefectures, except Wakayama, corresponding to the population size of each prefecture.

This study was approved by the Research Ethics Committee of the University of Tsukuba (No. 2020-1), and no potential conflict of interest exists relevant to this research. To protect respondents from mental disturbance possibly caused by answering our questionnaires, the letter of request included a summary of the contents of our survey. Also, participants could withdraw from the survey anytime, and all questions were set as non-mandatory.

Among the 5,650 replies, 3,406 were from women in the postpartum period with babies under 12 months of age. Among them, we used 2,878 responses of women who completed the entire survey for the present study.

## **Data collection**

We collected the data from the self-administered questionnaires. The Japanese version of the Edinburgh Postnatal Depression Scale (EPDS) was employed to measure depressive symptoms (Okano 1996). In the present study, a good internal consistency of the EPDS (10 items) was shown, with a Cronbach's alpha of 0.87. The questionnaires also collected perceived risk to wards with respect to COVID-19 infection and its negative consequences, unexpected experiences under the influence of this pandemic, and socio-demographic and economic information.

## **Analysis**

We first calculated the percentage of women with an EPDS score of  $\geq 9$  each month after delivery. Logistic regression analysis was performed by setting the dependent variable as 1: EPDS score of  $\geq 9$ ; 0: EPDS score of  $< 9$  after adjusting for the respondents' socio-demographic and economic backgrounds (refer Table 1 for the list of covariates and their definitions). We included three COVID-19 pandemic related variables: experiences during the COVID-19 pandemic, perceived risk, and place of residence; these variables were grouped into five based on the day the state of emergency was lifted in their prefecture. All statistical analyses were performed using STATA/MP 15.1.

Table 1 Summary statistics

Variable	Percentage/Mean	Std. Dev.	Min	Max
<b>Dependent Variable</b>				
EPDS $\geq$ 9 (1: EPDS $\geq$ 9, 0: EPDS $<$ 9)	26.96%	0.44	0	1
<b>Independent Variables</b>				
<u>COVID-19 related variables</u>				
Experiences during COVID-19				
Changes of place of delivery (1: Yes - 0: No )	1.49%	0.12	0	1
Cancellation of parenting classes (1: Yes - 0: No )	28.32%	0.45	0	1
Prohibition of visitors at hospitals (before and after the delivery) (1: Yes - 0: No )	36.03%	0.48	0	1
Prohibition of an entry of a partner into delivery room (1: Yes - 0: No )	22.45%	0.42	0	1
Cancellation of planed informal support (1: Yes - 0: No )	17.96%	0.38	0	1
Cancellation of planed formal support (1: Yes - 0: No )	35.06%	0.48	0	1
Life style changes with a partner working from home (1: Yes - 0: No )	32.73%	0.47	0	1
Perceived risk (COVID-19 related): How respondents think that she will be directly affected by following things in the next 6 months.				
Financial difficulties (1: Not at all likely - 7: Very likely)	3.53	1.84	1	7
COVID-19 infection (1: Not at all likely - 7: Very likely)	4.00	1.56	1	7
Not receiving formal childcare support (1: Not at all likely - 7: Very likely)	4.52	1.88	1	7
Not receiving informal childcare support (1: Not at all likely - 7: Very likely)	3.44	1.98	1	7
Place of residences: Mothers were grouped into following category based on the day ended the state of emergency. The longest duration was Tokyo/Kanagawa/Saitama/Chiba followed by Hokkaido, Osaka/Kyoto/Hyogo, and Aichi/Fukuoka.				
Tokyo/Kanagawa/Saitama/Chiba (1:	33.29%	47.13%	0	1

Tokyo/Kanagawa/Saitama/Chiba 0: otherwise)				
Osaka/Kyoto/Hyogo (1: Osaka/Kyoto/Hyogo 0: otherwise)	14.42%	35.14%	0	1
Aichi/Fukuoka (1: Aichi/Fukuoka 0: otherwise)	11.92%	32.41%	0	1
Hokkaido (1: Hokkaido 0: otherwise)	2.78%	16.44%	0	1
Other prefectures (1: other prefectures 0: otherwise)	37.60%	48.45%	0	1

### Respondents' socio-demographic, -economic information

Age of the respondents (mother's age)				
Age <25 years (1: age <25 years, 0: otherwise)	3.93%	19.43%	0	1
Age 25-29 years (1: 25 years<=age<30, 0: otherwise)	21.75%	41.26%	0	1
Age 30-34 years (1: 30 years<=age<35, 0: otherwise)	39.75%	48.95%	0	1
Age >=35 years (1: age >=35 years, 0: otherwise)	34.57%	47.57%	0	1
Multipara (1: multipara, 0: primipara)				
	42.22%	49.40%	0	1
Baby's age 6-11 months ( 1: 6 months<=baby's age<=11 months, 0: age<=5 months)				
	41.07%	49.20%	0	1
Household annual total income including tax				
Lower income group (1: < 5 million yen 0: >= 5 million yen)	43.15%	49.54%	0	1
Working/full-time housewife status				
Full-time employed worker (1: full-time employed worker, 0: otherwise)	50.31%	50.01%	0	1
Full-time housewife/student (1: full-time housewife/student, 0: otherwise)	30.13%	45.89%	0	1
Working for family business/ freelance (1:working for family business/ freelance, 0: otherwise)	2.40%	15.30%	0	1
Contracted/Part-time employed worker (1: contracted/part-time employed worker, 0: otherwise)	15.77%	36.46%	0	1

otherwise)				
Unemployed (under job search) (1: unemployed, 0: otherwise)	1.39%	11.71%	0	1
Highest educational attainment				
Educational attainment 16 years or more (1: >=16 years, 0:<16 years)	81.93%	38.48%	0	1
Marital status				
Married (1: married, 0: otherwise)	97.60%	15.30%	0	1
Unmarried (1: unmarried, 0: otherwise)	1.36%	11.56%	0	1
Divorced, widowed, the others (1: divorced, widowed, the others, 0: otherwise)	1.04%	10.16%	0	1
Number of family members who have been involved in childcare on a daily base Number of family members who have been involved in childcare on a daily bases in the past 2 months (We have specified the period as the past 2 months since it was the time most people have faced closure of childcare support center/nursery/kindergarten)	195.62%	153.09%	0	13
Number of household members (living with the respondent)	289.44%	134.08%	1	12
				n=2878

## Results

The point prevalence of postpartum women with an EPDS score of  $\geq 9$  was 26.96%. Some differences seemed to exist in the “month after delivery”, with the highest prevalence at 11 months (33.7%) and the lowest at 3 months (21.4%). Seven types of experiences during the COVID-19 pandemic were listed; 36.0% of mothers experienced prohibition of visitors at hospitals, 35.1% experienced cancellation of planned formal support, and 32.7% experienced lifestyle changes with a partner working from home. The highest perceived risk pertained to not being able to receive formal childcare support, followed by COVID-19 infection, financial difficulties, and not being able to receive informal childcare support. The respondents’ socio-demographic/economic variables showed that nearly 40% were in the age range of 30–34 years, nearly 98% were married, 42.2% were multipara, and 41.1% had a baby aged 6 months or older. About 80% of the respondents had more than 16 years of education. About 43.2% had an annual income (including taxes) of above 5 million yen, and approximately 50% were working full-time.

Logistic regression analysis concerning experiences of unexpected changes revealed that participants who had experienced cancellation of parenting classes and cancellation of planned childcare/postnatal support had a higher risk of having depressive symptoms (OR, 1.30; 95% CI, 1.04–1.63 and OR, 1.29; CI, 1.07–1.56, respectively). Mothers who had experienced lifestyle changes due to a partner working from home were affected positively and had a lower possibility of exhibiting depressive symptoms (OR, 0.81; 95% CI, 0.67–0.98). For perceived risk variables, mothers facing higher risks of financial difficulties and those who were not able to receive informal childcare support were independently associated with an EPDS score of  $\geq 9$  (OR, 1.10; 95% CI, 1.04 – 1.15 and OR, 1.22; CI, 1.15 – 1.29, respectively). However, no statistically significant association was observed for perceived risk of COVID-19 infection and for not receiving formal childcare support. Mothers who lived in areas with a longer duration of state of emergency had a higher probability of EPDS  $\geq 9$  (OR, 2.07; 95% CI, 1.25-3.41 for Hokkaido and OR, 1.47; 95% CI, 1.18-1.82 for Tokyo/Kanagawa/Saitama/Chiba). Some of the socio-demographic/economic variables showed a statistically significant association with depressive symptoms; for example, younger mothers, mothers 6 to 11 months after delivery (reference to 5 months or less), mothers with lower income, and unemployed mothers were more at a risk of having depressive symptoms.

Table 2 Results of logistic regression analysis

	Odds Ratio		[95% Conf. Interval]
<b>Experiences during COVID-19</b>			
Changes of place of delivery	1.70		0.89 3.27
Cancellation of parenting classes	1.30	*	1.04 1.63
Prohibition of visitors at hospitals (before and after the delivery)	0.98		0.74 1.30
Prohibition of an entry of a partner into delivery room	1.14		0.86 1.53
Cancellation of planed informal support	1.18		0.94 1.49
Cancellation of planed formal support	1.29	**	1.07 1.56
Life-style changes with a partner working from home	0.81	*	0.67 0.98
<b>Perceived risk (COVID-19 related)</b>			
Financial difficulties	1.10	**	1.04 1.16
COVID-19 infection	1.02		0.96 1.09
Not receiving formal childcare support	0.99		0.93 1.06
Not receiving informal childcare support	1.22	**	1.15 1.29
<b>Place of residence (Ref: Other provinces)</b>			
Tokyo/Kanagawa/Saitama/Chiba	1.47	**	1.18 1.82
Osaka/Kyoto/Hyogo	1.22		0.93 1.61
Aichi/Fukuoka	0.90		0.66 1.22
Hokkaido	2.07	**	1.25 3.41
<b>Age of the respondents (Ref: Age &lt;25 years)</b>			
Age 25-29 years	0.74		0.47 1.17
Age 30-34 years	0.62	*	0.39 0.98
Age >=35 years	0.54	**	0.34 0.86
<b>Multipara (Ref: Primipara)</b>			
Multipara (Ref: Primipara)	0.84		0.68 1.02
<b>Baby's age 6-11 months (Ref: age&lt;=5 months)</b>			
Baby's age 6-11 months (Ref: age<=5 months)	1.30	*	1.06 1.59
<b>Lower income group (Ref: &gt;= 5 million yen)</b>			
Lower income group (Ref: >= 5 million yen)	1.45	***	1.19 1.76



Working/full-time housewife status (Ref: Full-time employed worker)				
Full-time housewife/student	0.90		0.73	1.11
Working for family business/ freelance	0.98		0.54	1.78
Contracted/Part-time employed worker	1.12		0.86	1.44
Unemployed (under job search)	2.08	*	1.06	4.07
Educational attainment 16 years or more (Ref: < 16 years)				
	1.06		0.83	1.36
Marital status (Ref: Unmarried (never married) )				
Married	0.51		0.26	1.02
Divorced, widowed, the others	0.55		0.19	1.56
Number of family members who have been involved in childcare on a daily base in the past 2 months				
	0.94		0.88	1.00
Number of household members (living with the respondent)				
	1.03		0.95	1.11
Constant	0.21	**	0.08	0.52
Number of observations: 2878				
Log likelihood= -1551.1904				
LR chi2(30)= 252.75***				
Note: *** p<0.001, ** p<0.01, *p<0.05				

## Discussion

The percentage of mothers with depressive symptoms (EPDS  $\geq 9$ ) was remarkably higher than that found in normal circumstances in Japan; it was even higher than that after the Great East Japan Earthquake (Nishigori et al. 2014). In particular, mothers living in provinces with severe COVID-19 prevalence were at risk. Although Tokyo and its neighboring provinces had the highest reported number of COVID-19 patients in May 2020, Hokkaido was the first province in Japan that had seen an increase in COVID-19 patients in February and the only place that experienced the state of emergency twice since the end of February. Thus, it is likely that mothers in Hokkaido had the longest duration of self-isolation and less formal and informal support during prenatal and postnatal periods. We could observe two key issues related to the risk factors found in our analysis: decreased social support and economic uncertainty caused by the COVID-19 pandemic. Since the earlier work by O'Hara, Rehm, and Campbell (1983), the critical role of social support for postnatal depression has been discussed intensively, and its importance

has been constantly recognized across different times and places. In our analysis, the experience of cancellation of planned formal support was independently correlated with depressive symptoms even after taking into account the number of family members who were involved in childcare on a daily basis during the past two months. In addition, a higher perceived risk of not receiving informal support for childcare increased the risk of depression, with all other factors held constant. Low income has also been shown to be a fundamental risk factor for postpartum depression (Robertson et al. 2004). Our results showed a high OR for lower income group and unemployed mothers. Moreover, the perceived risk of financial problems was strongly associated with EPDS  $\geq 9$ , suggesting that economic uncertainty independently increased the risk.

### **Study limitation**

First, it was an online survey, in which we could obtain only an approximate response rate. The nature of the online survey based on voluntary participation was such that those who had severe depressive symptoms were probably not able to access this survey. Another limitation was that our survey data did not include information on the mothers' past psychiatric episodes and babies' health status that could be related to the mothers' mental health status pertaining to this study.

## **Conclusion**

We found a high prevalence rate of postnatal depression, associated with a negative effect of the COVID-19 pandemic. Given that the experience of pregnancy/becoming a mother can itself be considered a stressful event, the risk of postpartum depression was intensified with additional stressors caused by the COVID-19 pandemic, including voluntary social isolation and economic uncertainty. Both these issues are policy-relevant, implying that there are possibilities for intervention. Unless appropriate support is provided and economic recovery takes place immediately, deterioration in the mental well-being of postpartum women could last longer than the public health crisis of COVID-19.

## **Declarations**

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### **Conflicts of interest/Competing interests**

The authors declare no conflicts of interest associated with this manuscript.

### **Consent to participate**

Consent to participate for this study was obtained from participants.

### **Consent for publication**

Consent for publication was obtained from participants.

### **Availability of data and material**

Data can only be used by authors.

### **Code availability**

No.

### **Authors' contributions**

MM has conducted this research as a primary researcher doing all the following work; designed survey, managed and analyzed data, and write a paper.

HH co-authored this paper by designing survey, and revising a paper in collaboration with a primary researcher.

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