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Effect of the COVID-19 Pandemic on the Mental Status of Pregnant Women: A Single-Center Study

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Background: The coronavirus disease 2019 (COVID-19) pandemic has forced people to make major life changes, and there is concern that depressive tendencies have increased in pregnant women during the pandemic. This study used the Edinburgh Postnatal Depression Scale (EPDS), administered in the second trimester, to investigate the effect of COVID-19 on the mental health of Japanese women during pregnancy and to provide early intervention.

Methods: The study included 1,320 pregnant women (663 pre-COVID-19 and 657 during COVID-19) with similar background characteristics and compared the results for the COVID-19 period (September 2020-August 2021) and control period (September 2018-August 2019). Women treated for psychiatric disorders were excluded. The EPDS cutoff score was 13.

Results: The median EPDS scores were 3 (1-6) points during the control period and 3 (1-5) points during the pandemic ($p = 0.166$) for the control and pandemic periods. Fourteen patients (2.1%) during the control period and 20 (3.0%) during the pandemic scored ≥13 points; however, the difference was not significant (odds ratio, 1.455; 95% confidence interval: 0.692-3.143).

Conclusions: COVID-19 did not change mid-pregnancy EPDS scores at a single Japanese center.

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Key words: COVID-19 pandemic, Edinburgh Postnatal Depression Scale (EPDS), mental health, second trimester, depression

Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. It was first identified in China in December 2019 and has spread rapidly worldwide. By October 2022, the cumulative number of people infected with COVID-19 exceeded 620 million worldwide, and the cumulative number of deaths was greater than 6.5 million[1].

As the infection spread and the seriousness of the virus was recognized, cities around the world were sealed off and travel and outing restrictions were put in place to contain the outbreak. In Japan, a state of emergency was declared: events and travel were canceled, schools were closed, and other measures were implemented. Reduced face-to-face communication increased the risk of social isolation, which, coupled with economic uncertainty and job stress, may have caused anxiety and depression in many people, increasing the prevalence of major depression and anxiety disorders. The Global Burden Disease 2020 study estimated that the COVID-19 pandemic has led to a 27.6% increase (95% uncertainty interval [UI]: 25.1-30.3) in cases of major depressive disorders and a 25.6% increase (95% UI: 23.2-28.0) in cases of anxiety disorders worldwide in 2020. This trend was more pronounced in women than in men and in young people than in old people[2].

Pregnant and postpartum women experience physical and emotional instability and are at high risk of mental

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health problems. The Edinburgh Postnatal Depression Scale (EPDS) is a self-administered questionnaire developed as a screening tool for postpartum depression and is used internationally[3]. In Japan, many facilities use the EPDS to screen for postpartum depression at approximately 1 month postpartum. Depressive symptoms during pregnancy are strongly associated with postpartum depressive symptoms[4-6], suggesting that early detection of depression during pregnancy may help prevent postpartum depression. Although the EPDS was originally intended to assess postpartum depression in the first month postpartum, screening for depression during pregnancy is considered useful[7,8], and its use during pregnancy is becoming more acceptable. To identify patients at elevated risk for mental health issues and provide them with appropriate support from an early stage, our center administers the EPDS to pregnant women undergoing antenatal care at our hospital in the second trimester of pregnancy.

In addition to the known psychological vulnerability during pregnancy, the stress caused by the COVID-19 pandemic may have had a substantial impact on the psychological health of pregnant women. Using the EPDS administered in the second trimester, we investigated the impact of COVID-19 on the mental health of pregnant Japanese women.

Materials and Methods

The study protocol was approved by the Ethics Committee of Nippon Medical School Musashi Kosugi Hospital (Approval No. 726-5-37). In this study, we compared the results of the EPDS in mid-pregnancy performed during the COVID-19 pandemic (September 2020 to August 2021; n = 677) with those of the same test performed during the control period (September 2018 to August 2019; n = 681). The EPDS was administered during antenatal checkups that took place during the period from 16 weeks and 1 day to 27 weeks and 6 days of gestation. The EPDS questions are included in the **Supplemental Materials** (https://doi.org/10.1272/jnms.JNMS.2024_91-510). The responses were collected and tabulated on the same day. The pregnant women also completed a questionnaire on their background characteristics. In addition to work status, education, preferences, and method of conception, this questionnaire collected information on current and past treatments for mental disease, whether the patient's partner was cooperative, and whether the patient had a supportive person. Information on complications and history of illness was collected from medical records.

The EPDS is a perinatal depression screening tool that is intended to identify possible depression in pregnant women and facilitate early intervention. Because patients already being treated for psychiatric disorders, such as depression, require psychological intervention regardless of their EPDS scores and because this study aimed to identify new cases of perinatal depression attributable to the COVID-19 pandemic, women currently being treated for psychiatric disorders were excluded from the analysis.

The EPDS cut-off score varies by country because it reflects racial differences as well as environmental and other factors. In this study, the cut-off value for the EPDS in mid-pregnancy was set at 13 points, with a score of 13 or higher considered "positive." EPDS scores may also vary depending on the time of pregnancy[7,9]. The classification score of the postpartum EPDS in Japan is 8 or 9, and if the total score of the 10 items is 9 or higher, the patient is diagnosed as "likely to be depressed"[10]. The EPDS cut-off score is usually higher during pregnancy than postpartum[11]. Usuda *et al.*[12] found that a cut-off score of 13 for the EPDS during pregnancy in Japanese women had a sensitivity and specificity of 90% and 92.1%, respectively, and that 12 or 13 was the optimal cut-off value for Japanese pregnant women during pregnancy. Therefore, the cut-off was set at 13 points for this study.

If women had an EPDS score of 13 or higher in the second trimester, a midwife asked about their family environment and anxiety factors, and a liaison nurse intervened if necessary. If the liaison nurse determined during counseling that medication or psychiatric consultation was necessary, the patient was referred to a psychiatrist. We also analyzed each of the 10 questions in the EPDS to determine whether there was a change in scores before and after the COVID-19 pandemic.

EZR software was used for all statistical analyses. EZR is statistical software with extended R and R Commander functions and is available free of charge on the website of Saitama Medical Center, Jichi Medical University[13]. The t-test, Mann-Whitney U test, and Fisher exact test were used in the analysis, and a p value of <0.05 was considered to indicate statistical significance.

Results

The study sample included 1,358 patients (681 before and 677 during the COVID-19 pandemic). We excluded 18 and 20 patients, respectively, because they were receiving

Table 1 Psychiatric disorders excluded in this study

	Control (n=18)	COVID-19 pandemic (n=20)
Schizophrenia	3	1
Depression	6	8
Anxiety disorder/ Panic disorder	4	4
Obsessive-compulsive disorder	1	0
Adjustment disorder	2	2
Sleep disorder	1	4
Unknown details	1	1

Table 2 Participant characteristics

	Control	COVID-19 pandemic	p-value
Total	n=663	n=657	
Age	33.26±4.68	33.64±4.64	0.146
Pregnancy method			0.046
Assisted reproductive technology (%)	107 (16.2)	134 (20.5)	
Others (%)	554 (83.8)	519 (79.5)	
Parity			0.737
Primipara (%)	395 (59.6)	384 (58.6)	
Multipara (%)	268 (40.4)	271 (41.4)	
History of psychiatric disorders (%)	27 (4.1)	32 (4.9)	0.508
Absence of a partner (%)	4 (0.6)	4 (0.6)	1
Education			0.621
Junior high school (%)	9 (1.4)	7 (1.1)	
High school (%)	57 (8.6)	68 (10.4)	
Vocational school (%)	118 (17.9)	107 (16.4)	
College or higher (%)	477 (72.2)	471 (72.0)	
Work time			0.936
No work (%)	150 (23.0)	153 (23.7)	
<40 hours/week (%)	252 (38.6)	244 (37.8)	
≥40 hours/week (%)	251 (38.4)	248 (38.4)	
Lack of cooperation (%) (housework and childcare)	47 (7.1)	32 (4.9)	0.104
Lack of someone to consult (%)	3 (0.5)	3 (0.5)	1
Complications			
Hypertension (%)	7 (1.1)	6 (0.9)	1
Glucose intolerance (%)	15 (2.3)	15 (2.3)	1
Anemia (%)	19 (2.9)	21 (3.2)	0.751
Hypothyroidism (%)	25 (3.8)	24 (3.7)	1
Epilepsy (%)	7 (1.1)	5 (0.8)	0.773
Systemic lupus erythematous (%)	1 (0.2)	2 (0.3)	0.623

treatment for psychiatric disorders. **Table 1** shows the diagnoses for the 38 patients who were excluded because of psychiatric disorders. The responses of the remaining 663 (before the COVID-19 pandemic, control period) and 657 (during the COVID-19 pandemic) patients were analyzed. Three patients had a history of COVID-19 before responding to the EPDS. However, their EPDS scores were 1, 2, and 3, respectively, which were not high.

The background characteristics of the patients (**Table 2**) were balanced between the two groups. Assisted reproductive treatment tended to be more common during the COVID-19 pandemic; however, there were no significant differences in age, parity, education, or work status. Hypertension and glucose intolerance, which are relatively common complications, as well as anemia, hypothyroidism, epilepsy, and systemic lupus erythematosus, were selected as underlying diseases that may cause depressive symptoms[14–16]. Glucose intolerance included pregnancies complicated by diabetes and gestational diabetes mellitus diagnosed before EPDS testing. Anemia was de-

Table 3 Results of Edinburgh Postnatal Depression Scale (EPDS) assessment

EPDS	Control	COVID-19 pandemic	p-value	OR	95% CI
Median	3 (1-6)	3 (1-5)	0.166		
Median: history of psychiatric disorders	7 (4-10)	6.5 (3-9.25)	0.726		
≥13 points (%)	14 (2.1)	20 (3.2)	0.302	1.455	0.69-3.14

OR, odds ratio; CI, confidence interval.

Table 4 Characteristics of patients with an EPDS score ≥13

EPDS score ≥13 points	Control (n=14)	COVID-19 pandemic (n=20)	p-value
Median EPDS (IQR) score	13.5 (13-15.75)	14.0 (13.75-16.50)	0.234
Item 10 ≥1 point (%)	6 (42.9)	13 (65.0)	0.296
History of psychiatric disorders (%)	4 (28.6)	4 (20.0)	0.690
Homecoming delivery (%)	6 (42.9)	7 (35.0)	

Table 5 Perinatal outcomes for patients with an EPDS score ≥13 who delivered at our facility

Perinatal outcome	Control (n=8)	COVID-19 pandemic (n=13)	p-value
Preterm birth (%)	2 (25.0)	0	0.133
Caesarean section (%)	4 (50.0)	6 (46.2)	1
Hypertensive disorders of pregnancy (%)	1 (12.5)	1 (7.7)	1
Birth weight	3,084.75±663.9	3,047.77±345.87	0.868
Neonatal intensive care unit admission (%)	1 (12.5)	5 (38.5)	0.336

fined as hemoglobin (Hb) <11 on blood tests in the first trimester of pregnancy. The frequency of complications did not significantly differ between the two groups.

Table 3 summarizes the EPDS results. The median EPDS scores were 3 (1-6) points during the control period and 3 (1-5) points during the pandemic (p = 0.166). The number of pregnant women with a history of psychiatric disorders was 27 (4.1%) during the control period and 32 (4.9%) during the pandemic (**Table 2**). Pregnant women with a history of mental disorders had a median EPDS score of 7.0 (4-10) in the control group and 6.5 (3-9.25) during the pandemic, which was higher than that of pregnant women without a history of mental disorders; however, there was no significant difference between the control and pandemic groups (p=0.726).

Positive cases with a cutoff score of 13 or higher were compared to negative cases with a cutoff score of 12 or lower. There were 14 (2.1%) positive cases during the control period and 20 (3.0%) during the COVID-19 pandemic. The difference was not significant (p=0.302).

Table 4, 5 show a detailed study of patients with EPDS of ≥13 points. The median score was 13.5 (13-15.75) in the control group and 14.0 (13.75-16.50) during the COVID-19 pandemic. High percentages of patients in the control group (6; 42.9%) and COVID-19 pandemic group (13; 65%), checked item 10 ("a thought of wanting to hurt myself came to mind") with a score of 1 or more. Six (42.9%) patients in the control group and seven (35%) in the pandemic group requested a homecoming delivery. **Table 5** shows the perinatal outcomes of 21 patients with EPDS scores of 13 or higher who delivered at our institution. There were no significant differences in preterm delivery, caesarean section, hypertensive disorders of pregnancy complications, birth weight, or neonatal intensive care unit admissions between the control and pandemic periods.

Table 6 presents the analysis of each item in the EPDS. For most questions, there were no significant differences between the control and pandemic periods. For question 2 ("I look forward to doing things"), significantly more pregnant women felt that they "couldn't do much" during the COVID-19 pandemic.

Discussion

Few studies have compared the mental status of pregnant women in the same institution in Japan before and after the COVID-19 pandemic. At our institution, analysis of mid-pregnancy EPDS scores before and after the

Table 6 Responses to each item on the EDPS

	Control	COVID-19 pandemic	p-value
Q1			0.193
0	643	626	
1	17	28	
2	3	2	
3	0	0	
Q2			0.0477
0	631	606	
1	31	50	
2	1	1	
3	0	0	
Q3			0.0672
0	257	273	
1	224	243	
2	160	124	
3	22	17	
Q4			0.27
0	283	307	
1	165	153	
2	200	176	
3	15	21	
Q5			0.173
0	436	416	
1	157	186	
2	66	51	
3	3	3	
Q6			0.631
0	287	302	
1	278	272	
2	85	71	
3	13	12	
Q7			0.466
0	562	557	
1	83	78	
2	17	17	
3	1	5	
Q8			0.0892
0	485	490	
1	149	134	
2	27	23	
3	2	10	
Q9			0.178
0	616	602	
1	42	49	
2	4	1	
3	1	5	
Q10			0.14
0	627	622	
1	31	23	
2	5	12	
3	0	0	

COVID-19 pandemic showed no significant difference.

The COVID-19 outbreak forced people worldwide to make major changes in their lives. With forced restrictions on socioeconomic activities, the impact of COVID-19 on mental health has received increasing attention since the early stages of the pandemic. A systematic review of the global prevalence of major depressive disorder and anxiety disorders during the COVID-19 pandemic estimated that the COVID-19 pandemic increased major depressive disorder by 27.6% and anxiety disorder by 25.6%[2]. For both these disorders, women were more affected than men, and younger age groups were more affected than older ones[2]. The social and economic effects of infectious disease outbreaks affect women more than men. Women are more likely to be responsible for their children in cases of school closures and to care for sick family members. Women are also more likely to be economically disadvantaged during the pandemic because they tend to be paid less and have more precarious employment contracts than men. They are also at higher risk of exposure to domestic violence[17].

The perinatal period is the time in a woman's life when mental health problems are most likely to occur, and there is a concern that the COVID-19 pandemic increased depressive tendencies among pregnant and nursing women. During the pandemic, pregnant women had several concerns, including the risk to the mother and child from infection, anxiety about complications, and the possibility of a collapse of medical care, making it difficult to accept patients. In addition, restrictions on visitations and concerns about witnessed births may have exacerbated anxiety in pregnant women.

There are many reports on the psychological impact of the COVID-19 on pregnant women. A Chinese study that assessed the mental health of pregnant women for the first time since the COVID-19 outbreak found that the pandemic significantly increased the incidence of depressive symptoms among pregnant women, from 26.0% to 29.6%[18]. A survey of 1,764 pregnant women in Canada reported that 37% had an EPDS score of 13 or higher[19]. A systematic review and meta-analysis of 54 studies found that the prevalence of depression among pregnant women was 20.7% before the COVID-19 pandemic and 31.4% during the pandemic, a significant increase[20].

Several studies in Japan have investigated the adverse effects of COVID-19 on mental health during pregnancy and the postpartum period. Matsushima and Horiguchi examined the EPDS responses of 1,777 pregnant women obtained through an online survey and found that 17%

had EPDS scores of 13 or higher[21]. Obata *et al*.[22] also conducted a questionnaire survey of 4,798 pregnant women and found that 14.6% had EPDS scores of 13 or higher. The prevalence of depression among pregnant Japanese women, with an EPDS score of 13 as the cut-off, is not known. A meta-analysis of perinatal depression in Japanese women reported that 14.0% had an EPDS score of 9 or higher at mid-pregnancy[23], and the rate was even lower when a cut-off of 13 points was used. This suggests that the prevalence of depression during mid-pregnancy in Japan may have increased because of the COVID-19 pandemic but was lower than in other countries, perhaps because of the milder impact of COVID-19 in Japan.

Japan had by far the lowest number of COVID-19 cases and mortality rates worldwide in 2020. As of January 1, 2021, the cumulative confirmed cases per million people was 1,917.07 in Japan, 60,531.13 in the United States, 15,635.74 in Canada, 34,954.07 in Brazil, and 35,944.7 in Italy. The cumulative number of deaths per million people was 1,046.73 in the United States, 414.6 in Canada, 912.35 in Brazil, and 1,259.63 in Italy, as compared with 28.42 in Japan[24]. City blockades and penalties were imposed in many parts of the world; however, in Japan restrictions were limited to self-restraint in going out and traveling between cities and were not legally binding. The quality of medical care was also mostly maintained. These factors may have contributed to the lower rate of depression among pregnant women during the pandemic, as compared with rates in other countries.

This study analyzed data from an EPDS administered in the second trimester of pregnancy at a single center in Kawasaki City, Kanagawa Prefecture. The city is adjacent to Tokyo and has a population of more than 1.5 million and three perinatal centers, as well as hospitals and clinics scattered throughout the city, thus providing excellent access to medical facilities. As of September 1, 2020, the cumulative number of positive COVID-19 cases was 1,151 (31 cumulative deaths), and as of August 31, 2021, the cumulative number of positive COVID-19 cases was 34,902 (210 cumulative deaths), with daily updates on the city's COVID-19 incidence website[25].

Some responses from our center since the COVID-19 pandemic are listed below. In Japan, the Ministry of Health, Labor and Welfare placed restrictions on work in May 2020 because psychological stress due to the risk of COVID-19 infection could affect the health of pregnant female workers and their fetuses. The new law allowed pregnant female workers to limit their work periods, change to jobs with a lower risk of infection, and limit their work attendance. This required a Maternal Health Care Guidance Items Communication Card prepared by physicians for employers, which was actively used at our facility by pregnant women with strong reservations. In addition, at our facility, we canceled group classes for preparation for childbirth and childcare and created a system in which patients could watch DVDs in their private rooms. This allowed patients to receive information on parent education, caesarean section preparation, breast care, and other topics with a reduced risk of infection, even if group support was not available. After the acute phase of the COVID-19 pandemic had passed, commuting and work restrictions to avoid infection were lifted. However, the transition from group classrooms to individualized care continued even after the acute phase of the pandemic had passed because pregnant women's concerns about infectious diseases persisted. We believe that in a hospital setting, where the risk of infection is high, all possible infection prevention measures should be taken.

In Japan, some pregnant women undergo antenatal checkups in the area where they live and return to their hometown near the time of delivery to receive supportive care for themselves and their babies. However, the Japan Society of Obstetrics and Gynecology, the Japan Medical Association, and the Japan Society of Infectious Diseases of Obstetrics and Gynecology have declared that they do not recommend homecoming deliveries, to prevent the spread of COVID-19. Pregnant women who planned to return and deliver in their hometowns were unable to do so during the pandemic, and this may have caused them anxiety[26]. Indeed, it has been reported that those who were unable to go to their hometowns to give birth had higher EPDS scores than those who were able to go[21]. Although it has been shown that homecoming deliveries do not improve postpartum depression[27,28], they may affect mental health during pregnancy. Our facility informed pregnant patients that if they had difficulty receiving care locally, they could always receive care at our facility. In addition to the COVID-19 situation in Japan, these efforts may have contributed to the reduced mental health impacts during the pandemic.

In this study, EPDS scores before and after the pandemic did not substantially differ. However, participants indicated trouble when answering the question, "I have looked forward with enjoyment to things," suggesting that restrictions on people's movement, self-restraint from events, and decreased face-to-face communication

may have had an effect.

This study has some limitations. First, the sample size was small. Larger datasets are required in order to confirm that COVID-19 did not affect the mental health of pregnant women in Japan. Second, the cost of delivery at our facility is approximately $6,500, which is higher than in general public hospitals. The lump-sum maternity allowance provided by the government at the time of delivery was $3,500, and patients must thus pay approximately $3,000 out of their own pocket when giving birth at our hospital. Socioeconomic difficulties are associated with prenatal and postpartum depression[29], and the number of pregnant women with economic insecurity may have increased because of employment instability, while income may have decreased because of the COVID-19 pandemic. Thus, the current study may have excluded economically vulnerable individuals strongly affected by the COVID-19 pandemic, which may have biased our results.

It should also be noted that the EPDS is only a screening scale and not a measure of depression in pregnant women. History of depression is considered the most important risk factor for perinatal depression[30]. It has been reported that among women who suffered from major depression during pregnancy, nearly 50% had a history of depression before pregnancy. This study examined pregnant women with a history of psychiatric illness. Although it would have been preferable to examine depression, it was difficult to obtain detailed information on psychiatric disorders because of the lack of information in the questionnaire; therefore, the analysis was conducted using psychiatric disorders.

Conclusion

The COVID-19 pandemic did not appear to change the mental status of pregnant women in a single center in Japan during the second trimester of pregnancy. This may reflect the COVID-19 situation in Japan and/or measures taken at our hospital. Globally, the pandemic has resulted in deterioration in the mental health status of pregnant women, and appropriate supportive measures can minimize this effect.

Conflict of Interest: The authors declare no competing interests related to this study.

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