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Mentality of pregnant women and obstetric healthcare workers about prenatal SARS-CoV-2 testing: A regional survey over the first wave of the COVID-19 pandemic in Japan

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Abstract

Aim: To clarify the mentality of pregnant women and obstetric healthcare workers about prenatal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) screening testing.

Methods: A multicenter questionnaire survey about prenatal SARS-CoV-2 screening testing was conducted among pregnant women, midwives and nurses (M&Ns), and obstetricians at all delivery facilities in Fukui Prefecture between June 30, 2020 and July 22, 2020.

Results: Of 297 pregnant women, 150 (50.5%) underwent prenatal polymerase chain reaction (PCR) testing, and 107 of them (71.3%) answered that because of prenatal PCR tests, they could give birth with relief. One hundred forty-five (48.8%) were concerned about the disadvantages of receiving positive prenatal PCR results. Of 287 M&Ns, 151 (52.6%) answered that prenatal PCR screening testing could reduce anxiety about infection to themselves; this belief was more common among M&Ns working at the nonreception facility than among those at COVID-19 reception facilities (60.7% vs. 47.1%, $P = 0.02$). Of 57 obstetricians, 31 (54.4%) agreed to prenatal SARS-CoV-2 PCR screening testing, the rate of which was significantly higher among obstetricians at nonreception facilities than those at reception facilities (70.3% vs. 25.0%, $P < 0.01$). Fourteen obstetricians (24.6%) were concerned about excessive medical treatment for asymptomatic pregnant women with false-positive PCR results.

Conclusions: Pregnant women experience anxieties during the COVID-19 pandemic, and prenatal SARS-CoV-2 screening may reduce their anxiety to some extent. However, obstetrics staff at COVID-19 reception facilities are aware of the limits of prenatal screening and are concerned about excessive medical intervention due to false-positive results.

Key words: coronavirus disease 2019, pregnancy, SARS-CoV-2, screening, survey.

Introduction

The coronavirus disease 2019 (COVID-19), a life-threatening infection caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first emerged in Wuhan, China, in December 2019 and rapidly spread all over the world. One of the most concerning characteristics of COVID-19 is that SARS-CoV-2-infected patients become infectious prior to developing symptoms, which can easily lead to the spread of the infection without it being noticed; consequently, it has a serious impact on socioeconomic

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status. Although the development of an effective vaccine for COVID-19 is in progress,[1] people worldwide are living with considerable fear and anxiety against this unprecedented viral infection.

Maternal anxiety and depression have been correlated with obstetric complications and mental disorders in offsprings.[2] During this pandemic, pregnant women may have an increased risk of developing mental illness during pregnancy or the postpartum period. This is due to concerns about getting infected themselves or vertical transmission of infection to their offspring. Additionally, there is the psychological stress of an unprecedented self-restraint life. Obstetric healthcare workers are also confronted with the risks and fear of SARS-CoV-2 infection because the procedures undertaken during labor and delivery have a high likelihood of producing aerosols and respiratory droplets,[3] and asymptomatic disease reportedly exists in 1.6%–13% of pregnant women.[4–6] Appropriate care must be taken at the time of delivery during the pandemic.

In a nationwide survey, Umazume et al. reported that prenatal SARS-CoV-2 testing was conducted at 9%–17% of Japanese obstetric facilities.[7] The purpose of adopting prenatal COVID-19 testing in some obstetric institutions is potentially to decrease the anxiety of pregnant women or prevent nosocomial infections. Polymerase chain reaction (PCR) testing is the current gold standard for detecting SARS-CoV-2 infection in patients suspected of having COVID-19 with a sensitivity of approximately 70%, but there are potentially false-positive or false-negative results on PCR testing.[8, 9] Despite the introduction of prenatal PCR testing in some areas, it is completely unknown whether prenatal PCR testing contributes to reducing the anxiety of pregnant women or preventing nosocomial infections.

To clarify the influence of prenatal SARS-CoV-2 screening testing on pregnant women's mental health, we conducted a survey about the maternal mental state after the introduction of the prenatal SARS-CoV-2 screening testing system. Additionally, we examined the mentality of obstetric healthcare workers: midwives, nurses, and obstetricians about prenatal SARS-CoV-2 screening testing.

Materials and Methods

Fukui Prefecture is a local prefecture in Japan with a population of approximately 760 000 and a geographical area of 4190 km^2. The average income is 4 450 000 yen, and the educational standards are favorable in Japan. The local government and obstetricians in Fukui Prefecture established perinatal regional systems for the COVID-19 pandemic and classified the obstetrical facilities in which SARS-CoV-2-positive or SARS-CoV-2-negative pregnant women were treated after April 2020. Sixteen obstetrical facilities were classified into four perinatal medical centers for designated COVID-19-positive and three perinatal medical centers, two general hospitals, and seven obstetric clinics for designated COVID-19-negative pregnant women.

On April 5, 2020, Fukui Prefecture had 6.7 SARS-CoV-2-positive patients per 100 000 population, temporarily showing the worst COVID-19 prevalence rate in Japan. On April 24, 2020, prenatal SARS-CoV-2 PCR testing using nasopharyngeal swabs was started for asymptomatic pregnant women. This was based on the wishes of the individual patients who were worried about COVID-19 in the area. Until April 28, the total number of infected people in the Fukui Prefecture was 122 patients. For 2 months, there were no new infected patients. The test was performed in patients about 1–2 weeks before the expected date of delivery. The test results were typically available within 1–2 days, and the patients were informed about their results within days. Simultaneously, the patients were instructed to protect themselves from COVID-19 during the period between the PCR test and delivery.

Thereafter, a multicenter questionnaire survey was conducted between June 30, 2020 and July 22, 2020, among healthcare workers, including obstetricians and midwives and nurses (M&Ns) at all delivery facilities in Fukui, and pregnant women who underwent a postpartum medical examination 1 month after delivery in those facilities. All target pregnant women in this study delivered after the beginning of the regional perinatal COVID-19 countermeasure system in Fukui. The trends of COVID-19 in Fukui Prefecture during the questionnaire survey were the same as those in our previous report.[10] This study was approved by the Institutional Review Board of the University of Fukui (#20200010). Informed consent was obtained from all the participants in this study.

We distributed questionnaires to 350 pregnant women, 300 M&Ns, and 60 obstetricians among all 16 obstetric facilities in Fukui. Representative obstetric physicians at each facility collected answered questionnaires and mailed them to the division of

Obstetrics and Gynecology of the University of Fukui. We analyzed all collected data. The questionnaire for pregnant women was as follows: maternal age, homecoming delivery (Kisei-Bunben), whether they underwent prenatal SARS-CoV-2 PCR test, gestational age at the time of prenatal SARS-CoV-2 PCR test or delivery, delivery mode, and anxiety for pregnancy and childbirth. Homecoming delivery (Kisei-Bunben) is a general childbirth plan in Japan; pregnant women who live away from their hometown often return home to give birth and raise babies with the support of their parents and relatives. The questionnaire for M&Ns was as follows: whether to treat SARS-CoV-2-positive patients and mentality for prenatal SARS-CoV-2 PCR screening testing. The questionnaire for obstetricians was as follows: type of facility (perinatal medical center, general hospital, or obstetric clinic) and mentality for prenatal SARS-CoV-2 PCR screening testing.

For statistical analysis of categorical data, chi-squared or Fisher exact test was used. For continuous data, the Mann–Whitney U test was used. All analyses were conducted using the statistical software package JMP 14 (SAS Institute Inc., Cary, NC). A P-value <0.05 was set as statistically significant.

Results

During the study period, 298 pregnant women (85.1%) completed the questionnaire. One of them did not answer the question about undergoing prenatal PCR. Among the other 297 pregnant women, 150 (50.5%) underwent prenatal PCR testing and all received negative results. Table 1 shows a comparison of maternal characteristics between pregnant women with and without prenatal PCR tests. There were no significant differences between the two groups in maternal age, obstetric history, homecoming delivery, and delivery mode. Pregnant women who had undergone prenatal PCR testing gave birth significantly later than those who had not, possibly because the latter group of pregnant women gave birth before prenatal PCR testing. Table 2 shows the anxiety of pregnant women about the COVID-19 pandemic and their feelings about prenatal PCR tests. There were no

Table 1 Demographic characteristics of 297 pregnant women

	Total	Undergone prenatal PCR test	Not undergone prenatal PCR test	
	(n = 297)	(n = 150)	(n = 147)	p-value
Maternal age, years				0.81
<25	23 (7.7%)	9 (6.0%)	14 (9.5%)	
25–29	75 (25.3%)	37 (24.7%)	38 (25.9%)	
30–34	104 (35.0%)	53 (35.3%)	51 (34.7%)	
35–40	80 (26.9%)	43 (28.7%)	37 (25.2%)	
≤40	12 (4.0%)	6 (4.0%)	6 (4.1%)	
No answer	3 (1.0%)	2 (1.3%)	1 (0.7%)	
Obstetric history				0.31
Nullipara	124 (41.8%)	57 (38.0%)	67 (45.6%)	
Multipara	169 (56.9%)	90 (60.0%)	79 (53.7%)	
No answer	4 (1.3%)	3 (2.0%)	1 (0.7%)	
Homecoming delivery				0.39
Yes	86 (28.9%)	49 (32.7%)	37 (25.2%)	
No	204 (68.8%)	96 (64.0%)	108 (73.5%)	
No answer	7 (2.3%)	5 (3.3%)	2 (1.4%)	
Gestational age, weeks of gestation[a]				
Undergone prenatal PCR test	37.2 ± 1.19	37.2 ± 1.19	NA	NA
Delivery	38.8 ± 1.56	39.2 ± 1.40	38.5 ± 1.71	< 0.01
Delivery mode				0.64
Vaginal delivery	245 (82.4%)	128 (85.3%)	117 (79.6%)	
Cesarean section	49 (16.5%)	20 (13.3%)	29 (19.7%)	
No answer	3 (1.0%)	2 (1.3%)	1 (0.7%)	

Note: Following groups were compared: maternal age, <35 years old versus ≥35 years old, excluding "No answer"; obstetric history, nullipara versus multipara, excluding "No answer"; homecoming delivery, yes versus no, excluding "No answer"; delivery mode, vaginal delivery versus cesarean section, excluding "No answer."; Abbreviations: NA, not applicable; PCR, polymerase chain reaction.
[a]Data are shown as the average ± SD.

Table 2 Mental states of 297 participated pregnant women

	Total	Undergone prenatal PCR test	Not undergone prenatal PCR test	
	(*n* = 297)	(*n* = 150)	(*n* = 147)	*p*-value
Q1: What kind of anxiety did you have about pregnancy and childbirth due to COVID-19 pandemic? (*n* = 297)				
1. Infection to me	207 (69.7%)	103 (68.7%)	104 (70.7%)	0.70
1.1. Infection to me when going out	193 (65.0%)	95 (63.3%)	98 (66.7%)	0.55
1.2. Infection to me from my family living together	149 (50.2%)	82 (54.7%)	67 (45.6%)	0.12
1.3. Infection to me during prenatal checking up at hospital	86 (29.0%)	47 (31.3%)	39 (26.5%)	0.36
1.4. Infection to me during delivery	28 (9.4%)	14 (9.3%)	14 (9.5%)	0.96
2. Infection of my fetus	249 (83.8%)	126 (84.0%)	123 (83.7%)	0.94
3. Unknown about the influence of COVID-19 on pregnant women	171 (57.6%)	85 (56.7%)	86 (58.5%)	0.75
4. My family cannot visit me during hospitalization	173 (58.2%)	83 (55.3%)	90 (61.2%)	0.30
5. My family cannot attend delivery	101 (34.0%)	49 (32.7%)	52 (35.4%)	0.62
6. Disadvantages associated with prenatal PCR positive results	145 (48.8%)	73 (48.7%)	72 (49.0%)	0.96
6.1. Possibility of changing delivery facility if prenatal PCR test is positive	52 (17.5%)	27 (18.0%)	25 (17.0%)	0.82
6.2. Possibility of giving birth by cesarean section if prenatal PCR test is positive	61 (20.5%)	33 (22.0%)	28 (19.0%)	0.53
6.3. Possibility of not meeting neonate or not breastfeeding if prenatal PCR test is positive	100 (33.7%)	48 (32.0%)	52 (35.4%)	0.54
6.4. Possibility of being isolated during hospitalization if prenatal PCR test is positive	41 (13.8%)	18 (12.0%)	23 (15.6%)	0.36
Q2: What did you feel after undergoing prenatal PCR test? (n = 150)				
	Total (*n* = 150)			
1. Owing to prenatal PCR testing				
1.1. I could live a pregnant life with relief	88 (58.7%)			
1.2. I could give birth with relief	107 (71.3%)			
1.3. I could take postpartum childcare with relief	32 (21.3%)			
1.4. I could have my family relieved	71 (47.3%)			
1.5. I could have my friend relieved	9 (6.0%)			
1.6. I was relieved because I knew that I was not a spreader of virus to other people	73 (48.7%)			
1.7. I was relieved because of less anxiety about in utero infection	97 (65.3%)			
2. I was uncomfortable because the sample collection was painful	37 (24.7%)			

Abbreviations: NA, not applicable; PCR, polymerase chain reaction.

significant differences in all answers against six questions (Q1) between pregnant women who underwent prenatal PCR tests and those who did not. The most significant anxiety concerning pregnancy and childbirth was infection to their fetuses rather than themselves (249/297 [83.8%] vs. 207/297 [69.7%]). One hundred forty-five (48.8%) women were concerned regarding the disadvantages of receiving positive prenatal PCR results, such as the possibility of changing delivery facility, giving birth by cesarean section, not meeting neonate or not breastfeeding, and being isolated during hospitalization. Among the 150 women who underwent prenatal PCR tests, 88 (58.7%) answered that they could live the pregnant life with relief, and 107 (71.3%) answered that they could give birth with relief. Although there were positive opinions, 37 of 150 (24.7%) pregnant women felt that the sample collection was painful and uncomfortable.

Table 3 shows the results of the questionnaire to M&Ns. A total of 287 (95.7%) M&Ns answered the

Table 3 Questionnaire to midwives and nurses about prenatal PCR testing (n = 287)

	Total (n = 287)	Reception facility of COVID-19 (n = 170)	Nonreception facility of COVID-19 (n = 117)	p-value
Q1: Do you agree with the usefulness of prenatal PCR screening testing in avoiding nosocomial infection?				0.61[a]
1. Strongly agree	78 (27.2%)	42 (24.7%)	36 (30.8%)	
2. Agree	149 (51.9%)	89 (52.4%)	60 (51.3%)	
3. Disagree	32 (11.1%)	20 (11.8%)	12 (10.3%)	
4. Unknown	22 (7.7%)	14 (8.2%)	7 (6.0%)	
5. No answer	6 (2.1%)	5 (2.9%)	1 (0.9%)	
Q2: What did you think about prenatal PCR testing for asymptomatic pregnant women?				
1. It decreased anxiety about infection to me	151 (52.6%)	80 (47.1%)	71 (60.7%)	0.02
2. It decreased anxiety about becoming the source of infection to my family	126 (43.9%)	69 (40.6%)	57 (48.7%)	0.17
3. It decreased anxiety about becoming the source of infection to other health care workers	123 (42.9%)	64 (37.6%)	59 (50.4%)	0.03
4. I was relieved because of decreased anxiety of pregnant women	174 (60.6%)	96 (56.5%)	78 (66.7%)	0.08
5. I was relieved because of decreased anxiety of the family of pregnant women	87 (30.3%)	51 (30.0%)	36 (30.8%)	0.89
6. It decreased the use of unnecessary PPE	74 (25.8%)	51 (30.0%)	23 (19.7%)	0.05
7. It could avoid special care for pregnant women or neonates	89 (31.0%)	60 (35.3%)	29 (24.8%)	0.06
8. It was not effective or useful for medical care	26 (9.1%)	15 (8.8%)	11 (9.4%)	0.87

Abbreviations: PCR, polymerase chain reaction; PPE, personal protective equipment. [a]Comparison between categories: "1. Strongly agree" and "2. Agree" versus "3. Disagree" excluding "4. Unknown" and "5. No answer."

questionnaire; 90 (31.4%) were working at an obstetric clinic, 123 (42.9%) at a general hospital, 71 (24.7%) at the perinatal medical center, and 3 (1.0%) at other institutions (Figure 1(a)). Of the 287 M&Ns, 227 (79.1%) agreed to the usefulness of prenatal SARS-CoV-2 screening testing to avoid nosocomial infection. One hundred seventy-four (60.6%) answered that they could have relief owing to decreased anxiety among pregnant women. This was observed more in M&Ns working at nonreception facilities than in those working at COVID-19 reception facilities (78/117 [66.7%] vs. 96/170 [56.5%], P = 0.08).

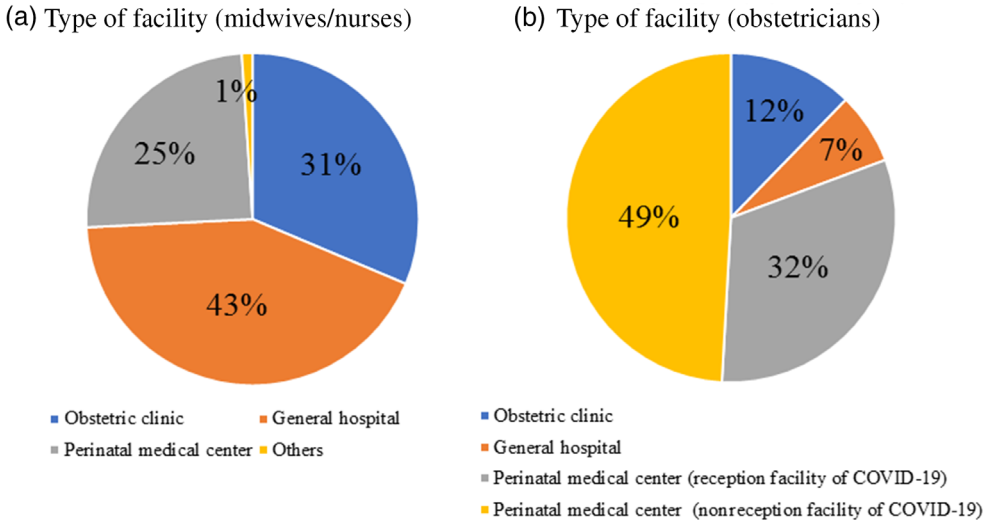

Figure 1 Pie charts representing the type of facility of (a) midwives and nurses (n = 287) and (b) obstetricians (n = 57) who cooperated with this questionnaire survey

One hundred twenty-three (42.9%) considered that it could reduce anxiety regarding infecting other healthcare workers. This was significantly observed more in M&Ns working at nonreception facilities than those at reception facilities of COVID-19 (59/117 [50.4%] vs. 64/170 [37.6%], $P = 0.03$).

A total of 57 (95.0%) obstetricians answered the questionnaire; 7 (12.3%) were working at an obstetric clinic, 4 (7.0%) at a general hospital, 18 (31.6%) at the perinatal medical center that treated COVID-19, and 28 (49.1%) at perinatal medical centers that did not treat COVID-19 (Figure 1(b)). Table 4 shows the results of the questionnaire for 57 obstetricians regarding their opinions on prenatal SARS-CoV-2 PCR screening testing. The number of obstetricians who agreed with prenatal SARS-CoV-2 screening for asymptomatic pregnant women was 31 (54.4%), whereas 19 (33.3%) disagreed. Obstetricians at nonreception facilities of COVID-19 agreed with prenatal SARS-CoV-2 PCR screening testing significantly more than those at reception facilities (26/37 [70.3%] vs. 5/20 [25.0%], $P < 0.01$). The number of obstetricians who considered the advantage of prenatal SARS-CoV-2 screening testing as the relief for M&Ns was larger in those at nonreception facilities than in reception facilities of COVID-19 (32/37 [86.5%] vs. 12/20 [60.0%], $P = 0.04$). Fourteen obstetricians (24.6%) considered that prenatal SARS-CoV-2 screening testing might induce excessive medical treatment for asymptomatic patients, and 18 (31.6%) considered that PCR testing was not sufficient for the exact diagnosis of COVID-19 because of the inspection uncertainty. Finally, 31 (54.4%) obstetricians considered that the prenatal SARS-CoV-2 screening testing system should be maintained until the establishment of an effective vaccine or medication. On the other hand, 24 (42.1%) thought that it should not be used for asymptomatic low-risk pregnant women and should be preferred only in high-risk populations.

Discussion

In this regional multicenter survey, half of the pregnant women underwent prenatal PCR screening tests in our area, and 70% of them answered that they could give birth with relief after the test. Of the M&Ns, 60% thought that prenatal PCR screening tests could decrease anxiety in pregnant women. M&Ns working at the nonreception facility considered that prenatal PCR screening tests decreased their anxiety about nosocomial infection more than those at the reception facilities of COVID-19. Half of all obstetricians agreed with prenatal SARS-CoV-2 screening testing for asymptomatic pregnant women. On the other hand, about 30% of them showed the opposite views regarding prenatal SARS-CoV-2 screening testing for low-risk pregnant women, and one-fourth of them worried about excessive medical intervention for pregnant women who received false-positive results by prenatal PCR screening tests. Obstetricians working at nonreception facility considered that healthcare workers can be relieved owing to prenatal PCR screening tests more than those at the reception facilities of COVID-19.

Perinatal mental health disorder in the pandemic period is a pivotal challenging problem worldwide. A previous study on maternal mental health in the COVID-19 pandemic reported that half of the pregnant women experienced anxiety about their own health during the pandemic, which was about 17% prior to the COVID-19 pandemic.[11] Although there is limited information on whether SARS-CoV-2 can have a more severe impact on pregnant than nonpregnant women, some reports indicated that pregnant women might have potential risks of developing serious conditions from COVID-19 that might be due to physiologic changes in pregnancy including increased oxygen consumption, decreased lung capacity caused by the raised diaphragm, compromised immune system, or increased risk of acute coagulopathy.[12, 13] In addition, they may continue feeling anxious about the risks of SARS-CoV-2 vertical transmission to unborn babies. Notably, under this unprecedented pandemic situation, lifestyles have drastically changed in that they have to keep physical distance from other people, even their own family members, which could cause home isolation of pregnant women and make them more depressed.

As shown in Table 2, most pregnant women who tested negative thought that prenatal SARS-CoV-2 screening tests could decrease anxieties about the viral infection to themselves, their offspring, and their families. In contrast, Bender et al. reported that, in Philadelphia, about 72% of asymptomatic pregnant women who tested negative felt no change in the already existing fear or anxiety.[14] The difference in maternal feelings about prenatal PCR testing between these two areas is probably attributed to the higher prevalence of COVID-19 in Philadelphia than in Fukui. Furthermore, while the research in Philadelphia was targeted to two hospitals that treated

Table 4 Questionnaire to obstetricians about prenatal PCR testing (n = 57)

	Total	Reception facility of COVID-19	Nonreception facility of COVID-19	
	n = 57	n = 20	n = 37	p-value
Q1: What do you think about prenatal PCR testing for asymptomatic pregnant women?				<0.01[a]
1. Agree	31 (54.4%)	5 (25.0%)	26 (70.3%)	
2. Disagree	19 (33.3%)	13 (65.0%)	6 (16.2%)	
3. Not sure	2 (3.5%)	2 (10.0%)	0 (0.0%)	
4. No answer	5 (8.8%)	0 (0.0%)	5 (13.5%)	
Q2: What do you think about the advantage of prenatal PCR testing for asymptomatic pregnant women?				
1. Obstetricians can be relieved	27 (47.4%)	6 (30.0%)	21 (56.8%)	0.05
2. Pregnant women can be relieved	36 (63.2%)	11 (55.0%)	25 (67.6%)	0.34
3. Midwives and nurses can be relieved	44 (77.2%)	12 (60.0%)	32 (86.5%)	0.04
4. We can maintain same number of deliveries as before	5 (8.8%)	1 (5.0%)	4 (10.8%)	0.65
5. We can manage pregnant women who have moved from high-epidemic areas	19 (33.3%)	2 (10.0%)	17 (45.9%)	<0.01
6. We can decrease the excessive PPE for assist of vaginal delivery	18 (31.6%)	5 (25.0%)	13 (35.1%)	0.56
Q3: What do you think about the disadvantage of prenatal PCR testing for asymptomatic pregnant women?				
1. It could induce excessive medical treatment for asymptomatic patients	14 (24.6%)	5 (25.0%)	9 (24.3%)	1.00
2. It could disturb pregnant women until the results come out	10 (17.5%)	2 (10.0%)	8 (21.6%)	0.47
3. It is not enough for COVID-19 diagnosis because of the problem of accuracy	18 (31.6%)	8 (40.0%)	10 (27.0%)	0.31
Q4: What do you think about the future ideal prenatal COVID-19 screening system?				
1. Prenatal PCR screening testing system should be maintained until the establishment of an effective vaccine or medication	31 (54.4%)	4 (20.0%)	27 (73.0%)	<0.01
2. Prenatal PCR screening testing should not be used for asymptomatic low-risk pregnant women	24 (42.1%)	14 (70.0%)	10 (27.0%)	<0.01
3. Antigen or antibody testing should be adopted	16 (28.1%)	5 (25.0%)	11 (29.7%)	0.77
4. Prenatal PCR testing is not needed under enough PPE	3 (5.3%)	2 (10.0%)	1 (2.7%)	0.28

Abbreviations: PCR, polymerase chain reaction; PPE, personal protective equipment.
[a]Comparison between categories: "1. Agree" versus "2. Disagree."

patients with COVID-19, the majority of pregnant women in our study delivered at obstetric facilities that did not treat patients with COVID-19. The present results suggest that prenatal SARS-CoV-2 screening may help reduce anxiety in pregnant women, but its usefulness may vary depending on the infection status in each area.

Healthcare workers, especially those caring for patients with COVID-19 at the frontline, also have a great psychological burden.[15, 16] It is inferred that obstetric healthcare workers tend to have anxiety about viral transmission to themselves through close contact with pregnant women during birth assistance despite the thorough use of personal protective equipment. In this study, approximately 80% of obstetricians expected that prenatal SARS-CoV-2 screening testing might reduce the anxiety of M&Ns, but only about 50% of M&Ns actually achieved a sense of security. As shown in Table 3, the proportion of M&Ns who felt the benefit of prenatal SARS-CoV-2 screening testing was lower in those working at reception facilities of COVID-19 than at nonreception facilities. This might reflect that during the pandemic period, M&Ns working at reception facilities cannot be relieved by PCR testing alone because they take the situation more seriously and need some combined countermeasures for infection control. To obtain a robust conclusion about the effect of prenatal SARS-CoV-2 screening testing for the mental health of M&Ns, a more objective and psychological evaluation of those caring for infected pregnant women in a high-epidemic area is needed.

Given the answers regarding pregnant women who moved from high-epidemic areas and the future

prenatal PCR screening system (Table 4), obstetricians, especially those at reception facilities, did not seem to fully trust the PCR tests because of the potential risk of false-negative results. Some obstetricians were also concerned with excessive or inappropriate medical intervention in pregnant women with false-positive results, especially in low-prevalence areas. In addition, half of the surveyed pregnant women worried about the disadvantages associated with positive results. Surkova et al. recently reported that SARS-CoV-2 PCR testing for asymptomatic patients can affect the false-positive rate or positive predictive values under the low prevalence in the United Kingdom.[17] Currently, the major Japanese academic societies of obstetrics and gynecology have stated that cesarean delivery is a reasonable delivery mode and that breastfeeding should be avoided in pregnant women with COVID-19.[18] Therefore, if prenatal SARS-CoV-2 testing is intentionally conducted in asymptomatic pregnant women, it should be essential to explain the patients about the disadvantages of the testing and the possibility of PCR retesting when false-positive results cannot be denied.

In the target period of this study, all prenatal PCR tests were conducted using nasopharyngeal swab specimens. Collecting nasopharyngeal swab specimens could expose healthcare workers to the SARS-CoV-2 virus through aerosols from swabbing.[19] Moreover, pregnant women could become uncomfortable with swabbing. In our survey, one-fourth of pregnant women felt that nasopharyngeal swabbing was uncomfortable due to pain. Recent studies have demonstrated that saliva specimens could become an alternative not only for the diagnosis of COVID-19 but also for the screening of COVID-19 in asymptomatic patients.[20–26] Therefore, using saliva specimens might become the reasonable inspection method for prenatal SARS-CoV-2 PCR testing.

This study has several limitations. First, there were no SARS-CoV-2-positive pregnant women managed in our area during the target period of this survey; thus, we could not evaluate the effect of prenatal SARS-CoV-2 screening test on the mental health of infected pregnant women and the feelings of healthcare workers who actually managed SARS-CoV-2-positive patients. Second, the questionnaire in this study was not a psychological test; hence, objective or quantitative evaluation of anxiety was not conducted. Third, because this was a multicenter survey, the method of informing pregnant women of PCR tests may have affected the mentality of those patients. Prenatal PCR testing for asymptomatic pregnant women conducted at some obstetric institutions in Japan is probably aimed at decreasing anxiety or preventing nosocomial infection, but validity is still controversial. To know what the patients felt after receiving the prenatal SARS-CoV-2 screening test or how the healthcare workers felt against the "controversial testing" is important for the future validation of prenatal PCR testing for asymptomatic pregnant women in Japan. As previously reported, from the perspective of pregnant women's mental health, it might be reasonable to provide prenatal SARS-CoV-2 PCR tests to those with anxiety about COVID-19.[10] In that case, the patients should be informed of the potential risks or disadvantages of undergoing prenatal PCR screening tests.

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Conflict of Interest

The authors declare no conflicts of interest.

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