Awareness about transmission and preventive measures of COVID−19 from mother to child: A cross−sectional study among pregnant women

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ABSTRACT

Objective: To study the knowledge, attitude, and practice of pregnant women regarding transmission and preventive measures of COVID-19 from mother to child and to determine the reasons for vaccine hesitancy.

Methods: This observational cross-sectional knowledge, attitude, and practice study was conducted among pregnant women of any trimester, attending the antenatal care out-patient department of a tertiary care hospital in Lucknow from October 2020 to March 2021. All the participants were interviewed using a pretested semi-structured questionnaire for desired information. Reasons for vaccine hesitancy were also asked to assess their unwillingness to get vaccinated.

Results: Totally 652 pregnant women were included and 91.3% were aware that COVID-19 spread through contact with an infected person and 85.3% knew that COVID-19 spread by respiratory droplets. Of pregnant women, 95.7% perceived that social distancing and wearing a proper mask were effective ways to prevent SARS-CoV-2 infection and 96.8% of the pregnant women wore masks regularly when going out. Of pregnant women, 79.0% were hesitant to get vaccinated. The most common reason was that COVID-19 vaccine can harm the developing fetus (77.5%) and was not very safe in pregnancy (75.0%).

Conclusions: Of the pregnant women, 22.92% have unsatisfactory knowledge regarding COVID-19, 35.63% have negative attitude and 19.93% have poor practices, indicating that there are still gaps in awareness, and majority of them are unwilling to get vaccinated. Good awareness will help prevent the occurrence of future COVID-19 waves in India.

KEYWORDS: COVID-19; Pregnant women; Awareness; Transmission; Preventive measures; Vaccine hesitancy

1. Introduction

The novel coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), and has already taken on pandemic proportions, affecting the whole world in the minuscule of time[1–3]. The whole world is experiencing the menace of this pandemic in form of a series of waves occurring at unrelated intervals including India. This is attributed to the fact that the dense population of India fails to adhere to the COVID-19 appropriate behaviour due to which the pandemic not only affects the people but also the health system[4,5].

> **Significance**
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> Vaccine hesitancy is very high among pregnant women due to a lack of trials on the safety of vaccines in pregnancy. The present study has observed that there are gaps in the awareness of COVID-19 and its preventive measures among the pregnant women, causing significant and adverse implication on the vaccine uptake by this vulnerable population. This study highlights the importance of good knowledge and positive attitude of COVID-19 preventive measures with special focus on vaccination among pregnant women and consequently healthy and uneventful antenatal period with good feto-maternal outcome.

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The most important factor in preventing the spread of the virus locally is to empower the citizens with the right information and take advisories being issued by the Ministry of Health & Family Welfare, Government of India regularly. To guarantee the final success, people's adherence to these control measures is essential, which is largely affected by their knowledge, attitudes, and practices towards COVID-19 under knowledge, attitude, and practice theory[6,7].

Pregnant women form a vulnerable group due to various physiological changes in pregnancy putting them at a higher risk for contracting a severe infection[8]. Indian Council of Medical Research (ICMR) has reported that pregnant and post-partum women were worst affected in the second wave of COVID-19 infection in India as compared to the first with the more symptomatic and severe form of the disease and poor feto-maternal outcomes[9]. Since the safety and efficacy of COVID-19 vaccines have not been studied to date in any vaccine trial and there is the restriction of various drugs during pregnancy, the preventive measure is the only effective way to curb the COVID-19 in them[10]. For this, adequate knowledge, attitude, and practice regarding COVID-19 transmission and prevention is required.

Very few studies have been conducted among pregnant women for COVID-19 in India. Seeing the paucity of evidence from this region, our study will unravel this gap in their knowledge and understand the reasons for vaccine hesitancy among them, which will be beneficial in the implementation of vaccination guidelines for pregnant women. Therefore, the study was planned to study the knowledge, attitude, and practice of pregnant women regarding transmission and preventive measures of COVID-19 from mother to child and to determine the reasons for vaccine hesitancy.

2. Subjects and methods

2.1. Study design and setting

It was an observational cross-sectional study conducted among the pregnant women attending the antenatal care out-patient department of Obstetrics and Gynaecology Department of a tertiary care centre in Lucknow, India.

2.2. Study participants and eligibility criteria

The study included currently pregnant women aged 15-49 years of any trimester who were cooperative and gave informed verbal and written consent for data collection. Those pregnant women who were not cooperative during the interview were excluded.

2.3. Data collection tool and mmeasurements

Data were collected for 6 months *i.e.*, from October 2020 to March 2021. The purpose of the study was explained to all the study participants and confidentiality of information was maintained throughout. They were then subjected to a pretested semi-structured questionnaire to collect information about their knowledge, attitude, and practice regarding COVID-19.

The questionnaire consisted of two parts–demographic details and a knowledge, attitude, and practice (KAP) tool. Demographic variables included age, religion, education level, occupation, place of residence (urban or rural), and socioeconomic status (Modified BG Prasad classification 2021). The knowledge section consisted of two parts–13 questions regarding clinical symptoms, prevention, and control of the disease. Evaluation of attitude of the pregnant women was done by 5 questions assessing viewpoints on social distancing, control of COVID-19, and lockdown to prevent the spread of COVID-19. Regarding the assessment of practice, 9 questions were asked regarding the idea of grocery stocking, preventive measures during the lockdown, and relationships with family and friends. The responses to knowledge questions were rated on a 3 Likert Scale as yes, no and don't know. Further scoring was done as 1 for saying yes and 0 for no or don't know and reverse scoring for negative questions. The different types of response scales were determined based on the forms and appropriateness of questions asked. Similarly, attitude and practice questions had responses as yes or no and scoring was done as 1 for the positive attitude and good practices and 0 *vice–versa*. The final knowledge, attitude and practices score was sum of score of the number of items in the tool and mean was calculated. If the score of the study participant was more than the mean, then KAP was adequate and satisfactory. The content as well as face validity of the questionnaire was done on 100 participants and then modifications were done. The content validity indice (S-CVI) was 0.482 and it was acceptable. The COVID-19 KAP tool was also reliable with a Cronbach alpha value of 0.857. There was no multicollinearity observed between the items in the three domains of KAP.

Reasons for vaccine hesitancy were asked from the pregnant women who showed their unwillingness to get vaccinated. All the interviews were conducted by the same researcher and all efforts were made to minimize bias in the study. All the forms were reviewed for completeness and the woman was contacted again *via* telephone in case of inadequate information.

2.4. Sample size

For sample size estimation, finite population correction was applied to the sample size formula, *i.e.* $n = NX/ (X + N–1)$ where, $X = Za/2 \times p(1-p)/d$, taking p as the proportion of individuals with adequate knowledge about COVID-19 (value was 80.64%[11], then at 99% confidence interval and power of 80%, the minimum sample size (n) required was 652 pregnant females.

2.5. Sampling technique

The tertiary care centre where the study was conducted was one of the largest government medical colleges and research centres in the district of Lucknow and was also catering as a referral centre for nearby districts like Barabanki, Unnao, Kanpur, Lakhimpur, *etc* of the state of Uttar Pradesh, India. Pregnant women of any trimester attending the antenatal care of out-patient department of this centre were selected using systematic random sampling. With a sampling interval of 4, every fourth pregnant female fulfilling the inclusion criteria was enrolled in the study.

2.6. Statistical analysis

The data were analyzed using the licensed Statistical Package for Social Sciences (SPSS Inc., Chicago,Illinois, USA) version 22.0 software purchased by the institute (license number: DOEJWLL). A descriptive summary using frequencies, percentages, graphs, and cross tabs was used to present the study results. Mean knowledge, attitude, and practice scores were calculated. If the score was more than the mean, then knowledge was satisfactory, the attitude was positive, and practice was good. The scoring and calculation of proportions was done on SPSS.

2.7. Ethical consideration

This study was approved by the Institutional Ethics Committee of Dr. RMLIMS, Lucknow, India (IEC No. 61/20).

3. Results

3.1. Baseline characteristics of the study participants

More than two-thirds (69.2%) of the study participants were of the age group 26-35 years. A majority of them belonged to the rural area (72.7%) and were Hindu by religion (71.8%). 26.2%, 28.4% and 25.9% females had a primary, secondary, and intermediate level of education. Almost two-thirds (62.1%) of the pregnant females were homemakers. More than one-third of them (35.6%) belonged to the lower middle socioeconomic class. Almost half of the study participants (49.8%) were in the second trimester and 37.9% and 1-3 living children (Table 1).

3.2. Awareness regarding the transmission and preventive measures of COVID–19 from mother to child

A majority (75.8%) of the study participants knew that COVID-19 was caused by a virus. Almost 91.3% were aware that COVID-19 spread through contact with an infected person and 85.3% knew

Table 1. Sociodemographic characteristics of pregnant women (*n*=652).

Characteristics	Frequency (*n*)	Percentage (%)
Age group, years		
<18	2	0.3
18-25	157	24.1
26-35	451	69.2
>35	42	6.4
Residence		
Rural	474	72.7
Urban	178	27.3
Religion		
Hindu	468	71.8
Muslim	184	28.2
Education		
Iliterate	78	12.0
Primary	171	26.2
Secondary	185	28.4
Intermediate	169	25.9
Graduate and above	49	7.5
Occupation		
Business/Self employed	102	15.6
Wage earner	111	17.0
Student	34	5.2
Homemaker	405	62.1
Socioeconomic status *		
Upper	56	8.6
Upper middle	40	6.1
Middle	145	22.2
Lower middle	232	35.6
Lower	179	27.5
Trimester		
First	103	15.8
Second	325	49.8
Third	224	34.4
Number of living children		
0	304	46.6
1-3	247	37.9
>3	101	15.5

*Modified BG Prasad 2021.

that it spread by respiratory droplets. Maximum pregnant females knew that fever (96.8%) and difficulty in breathing (97.7%) were early signs of COVID-19. 93.4% of females were aware that COVID-19 spread from symptomatic cases although almost half of them had reported that it also spread from asymptomatic cases or from both. Nearly all (99.5%) of the pregnant women knew that COVID-19 could be prevented by maintaining social distancing. Only two-thirds knew that isolation of contacts was an important measure to prevent COVID-19 spread (64.3%). The majority of the pregnant women (96.8%) answered that diabetes led to more dangerous COVID-19. Only 80.2% knew that period of isolation for COVID-19 was 14 days. More than half (52.6%) reported that eating citrus fruits and 41.3% said that steam inhalation could prevent COVID-19. All the pregnant women answered that pregnant women were at more risk of contracting COVID-19 infection (100%) (Table 2).

Table 2. Knowledge regarding transmission and prevention of COVID-19.

Questions	Responses					
	Yes		No		Do not know	
	n	%	*n*	%	*n*	%
COVID-19 is caused by						
Virus	494	75.8	65	10.0	93	14.2
Bacteria	34	5.2	618	94.8	0	0.0
Parasites	0	0.0	652	100.0	0	0.0
Immunodeficiency	0	0.0	652	100.0	0	0.0
Others	102	15.6	494	75.8	56	0.9
COVID-19 spread through						
Contact to an infected person	595	91.3	0	0.0	57	8.7
Respiratory droplets	556	85.3	12	1.8	84	12.9
Faeco-oral route	79	12.1	348	53.4	225	34.5
The early symptom of COVID-19 is						
Fever	631	96.8	0	0.0	21	3.2
Difficulty in breathing	637	97.7	9	1.4	6	0.9
Cough	582	89.3	41	6.3	29	4.4
Sore throat	210	32.2	139	21.3	303	46.5
Risk of spread of novel corona virus is from						
Symptomatic cases	609	93.4	6	0.9	37	5.7
Asymptomatic cases	313	48.0	123	18.9	216	33.1
Both	307	47.1	112	17.2	233	3.2
Important measures to stop spread of novel corona virus are						
Isolation of symptomatic case	419	64.3	89	13.7	144	22.1
Quarantine of susceptible contacts	517	79.3	57	8.7	78	12.0
Social distancing	649	99.5	0	0.0	3	0.5
Early screening	594	91.1	18	2.8	40	6.1
The disease is more dangerous among those with						
Diabetes	631	96.8	7	1.1	14	2.1
Cancer	521	79.9	58	8.9	73	11.2
Heart disease	565	64.3	44	13.7	43	22.1
Chronic respiratory disease	639	79.3	8	8.7	5	12.0
The duration of isolation of a person who came in contact with SARS-CoV-2 infected patient is						
14 days	523	80.2	61	9.4	68	10.4
7 days	52	8.0	530	81.3	70	10.7
10 days	77	11.8	524	80.4	51	7.8
Following are the ways to prevent SARS-CoV-2 infection						
Avoiding non vegetarian food	110	16.9	348	53.4	194	29.8
Eating citrus fruits	343	52.6	98	15.0	211	32.4
Gargling with salt water	171	26.2	209	32.1	272	41.7
Drinking alcohol	0	0.0	428	65.6	228	35.0
Steam inhalation	269	41.3	59	9.0	324	49.7
COVID-19 can transmit form mother to child						
In utero	321	49.2	124	19.0	207	31.8
During delivery	289	44.3	101	15.5	262	40.2
While breast feeding	347	53.2	84	12.9	221	33.9
Do you think that pregnant women are at more risk of contracting SARS-CoV-2 infection?	652	100.0	0	0.0	0	0.0
Do you think SARS-CoV-2 positive mother should breast feed?	204	31.3	338	51.8	110	16.9
Do you think that vaccine is a way to prevent COVID-19 in pregnancy and its transmission to baby?	137	21.0	322	49.4	193	29.6

3.3. Attitude of study participants regarding prevention of COVID–19

A majority (96.3%) of the pregnant women had the attitude that the novel coronavirus could be prevented by regular hand washing, 81.9% stayed at home to prevent the COVID-19, and 95.7% of pregnant women had the perception that social distancing and wearing a proper mask were effective ways to prevent COVID-19 infection. Most of the pregnant women (96.9%) felt that COVID-19 could be contracted during pregnancy during delivery or postpartum period. 80.8% of pregnant females perceived that sanitization of hospitals, public places, and buildings could prevent COVID-19 (Table 3).

Table 3. Attitude regarding transmission and prevention of COVID-19.

Questions	Responses			
	Yes		No	
	n	*%*	*n*	*%*
Novel SARS-CoV-2 can be prevented by regular hand washing	628	96.3	24	3.7
Avoiding a visit to populated places will prevent the spread of COVID-19	83	12.7	569	87.3
Social distancing and wearing a proper mask are an effective way to prevent SARS-CoV-2 infection	624	95.7	28	4.3
COVID-19 can be contracted in pregnancy during delivery or post-partum period	632	96.9	20	3.1
Sanitisation of hospitals, public places and buildings can prevent COVID-19	527	80.8	125	19.2

Table 4. Practices regarding transmission and prevention of COVID-19.

Questions	Responses			
	Yes		No	
	n	*%*	*n*	*%*
One should wear mask regularly when going outside for work	631	96.8	21	3.2
Maintain social distancing of 2 feet while visiting crowded places	612	93.9	40	6.1
Wash vegetables, fruits and groceries after buying	591	90.6	61	9.4
Wash hands regularly to prevent SARS-CoV-2 infection	598	91.7	54	8.3
One should stay at home to prevent the COVID-19	534	81.9	118	18.1
SARS-CoV-2 positive mother should breast feed the baby	124	19.2	527	80.8
SARS-CoV-2 positive mother should wear mask while breast feeding the baby	255	39.1	397	60.9
Pregnant women should get vaccinated for COVID-19	137	21.0	515	79.0
Lactating women should get vaccinated for COVID-19	273	41.9	379	58.1

Table 5. Reasons for vaccine hesitancy among the pregnant women (*n*=515).

Reasons for not getting COVID-19 vaccine	Frequency	Percentage
Can harm the developing foetus	505	77.5
Vaccine is not safe in pregnancy	489	75.0
Will complicate the pregnancy at the time of delivery	380	58.3
Will cause COVID-19 and it will transmit to the baby	342	52.5
Can cause congenital abnormalities in the baby inside the womb	144	22.1
Vaccine can cause mental retardation in the baby	114	17.5
Vaccine can kill the baby in utero	68	10.4
No effective studies reporting about efficacy of COVID-19 vaccine among pregnant women	23	3.5

3.4. Practices of pregnant women regarding prevention of COVID–19

A majority (96.8%) of the pregnant women wore masks regularly when going out. Although 21 pregnant females were still not wearing the mask on going out. Maximum females (93.9%) maintained a social distance of 2 feet while visiting crowded places. 90.6% of females washed vegetables, fruits, and groceries after buying. 91.7% females washed hands regularly to prevent COVID-19. Still, 54 females were not practicing hand washing properly. Almost four-fifths (81.9%) practiced staying at home to prevent COVID-19 (Table 4).

3.5. Vaccine hesitancy among the study participants

Out of 652 pregnant women, 515 were unwilling to get vaccinated for COVID-19. The most common reasons were that vaccines could harm the developing fetus (77.5%), were not very safe in

pregnancy (75.0%), would complicate the pregnancy at the time of delivery (58.3%), would cause COVID-19 disease, and would transmit to the baby (52.5%), could cause congenital abnormalities in the baby inside the womb (22.1%), could cause mental retardation in the baby (17.5%), could kill the baby in utero (10.5%) and no effective studies reporting about the efficacy of COVID-19 vaccine among pregnant women (3.5%) (Table 5).

3.6. Knowledge, attitude, and practice scores of the study participants

Overall, 77.08% of pregnant females had satisfactory knowledge about COVID-19. However, only two-thirds (64.37%) had a positive attitude toward preventing COVID-19 and finally 80.07% were having good practices for preventing COVID-19 (Figure 1).
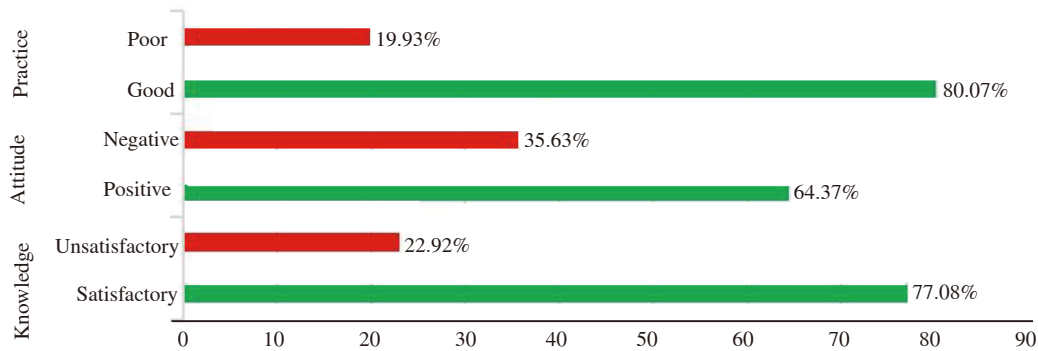
Figure 1. Knowledge, attitude, and practices of the pregnant women in the study.

4. Discussion

COVID-19 infection is a public health problem and adequate knowledge among the populace is essential for its management. The second wave of COVID-19 in India was a huge public health crisis and resulted in a major toll of cases with severe disease and consequently caused many deaths. Only COVID-19 appropriate behaviour will be able to prevent the expected third wave. Currently, COVID-19 is endemic in India with spurt of cases in small clusters in different parts of the country at different time intervals. The major variant circulating in the population is Omicron. Cases reported are generally mild to moderate with very low proportion of severe cases. Vaccination plays a vital role in reducing the severity of disease. A pregnant female is susceptible to COVID-19 infection and severe disease, so prevention is the best approach for managing COVID-19 in them. It has been demonstrated that adequate knowledge is a prerequisite for the establishment of preventive belief, forming a positive attitude, and promoting a positive practice of disease[12].

The present study has observed that 77.08% of pregnant women had satisfactory knowledge regarding COVID-19 disease, 64.37% had a positive attitude and 80.07% had good practices which will help prevent the occurrence of the expected third wave in India. This agrees with the study conducted by Kaur *et al* among Indian pregnant women who also observed satisfactory knowledge and positive attitudes among most of the pregnant women[8]. Other researchers from Iran (90%), Pakistan (93.2%), China (90%), and Tanzania (84.4%) have also reported adequate and higher knowledge regarding COVID-19 as compared to our findings[13–16]. The difference may be associated with variations in socio-demographic characteristics, study setting, and study participants. The other possible reason might be disparities in the presence of trained human resources and health care systems of the countries to create awareness regarding the pandemic[17].

In our study, 75.8% of pregnant females knew that COVID-19

is caused by the virus, but this was slightly less than the findings by Anikwe *et al* who reported the same among 88% of pregnant females[12], and more than that by Degu *et al* who reported that 64.2% knew that COVID-19 was caused by a virus[17]. This variation is subjected to the different levels of education among the pregnant females and different study settings as urban areas report better knowledge due to good access to multimedia and other facilities. Kasemy *et al* conducted a knowledge, attitude, and practice study among the general population of Ethiopia and found that 100% of the study participants knew that COVID-19 is a viral disease[18]. Being a low resource country, the awareness among the population was good. A majority of the pregnant women in our study knew that COVID-19 spreads mostly through contact with the infected person (91.3%) and secondly by respiratory droplets (85.3%). This is similar to the findings of Degu *et al* who reported that 88.2% of pregnant females knew the same[17]. In our study, 96.8% and 97.7% of pregnant females respectively knew that early signs of COVID-19 are fever and difficulty in breathing and this was in concordance with studies by other researchers in low-income countries like Ethiopia (88.58%) and Ghana (85.6%) as well as from India (98%)[8,17,19]. The adequate knowledge could be attributed to robust efforts by the government of India in spreading information and increasing awareness regarding COVID-19 since the beginning of the pandemic[8].

All the study participants (100%) in our study reported that pregnant women are at more risk of contracting the COVID-19 disease. This percentage was higher than the study by Degu *et al* where only 49% of pregnant females said that they think that they can contract the disease[17]. This knowledge is important because pregnancy is a physiological immunosuppression state and makes the female vulnerable to contracting the COVID-19 which can be fatal for the in-utero fetus[8]. In the study by Kaur *et al* among pregnant women, 71% of females replied that there is no proven treatment for COVID-19, and only 13% of females knew vaccine was a cure[8]. So, this is an area where the government must

work actively in creating awareness regarding the vaccination for COVID-19.

More than 90% of the pregnant women had a positive attitude that COVID-19 can be prevented by hand washing, avoiding crowded places, maintaining social distance, and wearing a proper mask. This is slightly more than in studies by Anikwe *et al* (82%), Quansar *et al* (83%) Lee *et al* (81%)[12,20,21]. This difference might be due to the time of the studies conducted in which information delivery and awareness creation programs about the pandemic are ongoing and improving from time to time. For this reason, practices were expected to be low at the beginning of the pandemic. As far as practices were concerned, most of the pregnant women practiced COVID-19 appropriate behaviour, and this is in concordance with studies by other researchers[12,20,21]. Good practices are indicative of the robust efforts of the government in creating awareness regarding the disease through all the platforms among the general population[8].

Vaccine hesitancy was observed in 79% (515/652) of the pregnant women in this study. Ghoncu Ayhan *et al* have reported that 63% of pregnant females in Turkey were unwilling to get vaccinated and the most common reason was concern regarding their efficacy[22]. In a US-based study, it was observed that compared to other women of reproductive age, pregnant participants were six times more likely to delay COVID-19 vaccination and twice as likely to decline[23]. The key factor for hesitancy is that pregnant women were excluded from clinical trials of COVID-19 vaccines, despite being at increased risk of developing severe illness from COVID-19 causing adverse feto-maternal outcomes[24]. Several studies have also shown a small, 2% to 3% risk of vertical transmission and the presence of viral RNA in the breast milk of mothers infected with COVID-19, but the evidence is conflicting and non-conclusive[24,25].

There are some limitations of the study. Firstly, being a hospital-based study, it is difficult to generalize the results among all the pregnant women of Lucknow. Secondly, conducting a study by interviewing the people does not reflect their proper practices and a qualitative design will be beneficial in understanding the magnitude of this problem. Lastly, the social desirability barrier might have influenced the responses of the respondents. However, all efforts were made to reduce all such biases.

In conclusion, of the pregnant women, 77.08% have satisfactory knowledge regarding COVID-19, 64.37% have positive attitude and 80.07% have good practices, which will help prevent the occurrence of future COVID-19 waves in India. However, there are still gaps in awareness, and majority of them are unwilling to get vaccinated. There is a need to strengthen the health policies that encourage interpersonal discussion of COVID-19 preventive measures among pregnant women to improve their accuracy of knowledge, attitude, and practices for COVID-19 prevention and enhance a further reach of information to those who may not have access to radio and television in remote communities. This will enhance the uptake of COVID-19 vaccination during pregnancy.

Conflict of interest statement

The authors declare there is no conflict of interest.

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Authors' contributions

Neetu Singh and Sugandha Jauhari contributed to participating in conception and designing of the study, conducting the literature review and collecting data. Sugandha Jauhari did the data analysis and drafting of the manuscript. Neetu Singh contributed to interpretation of results and revision of manuscript. Both the authors approved the final version of manuscript.

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