COVID-19 vaccination acceptance and adherence among pregnant and lactating high-risk group individuals of Maharashtra State, India

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Abstract:

BACKGROUND: Since the outbreak of the pandemic, the release of the COVID (Corona Virus Disease)-19 vaccine was highly anticipated. Nevertheless, vaccine availability does not symbolize the end of pandemic due to ongoing vaccine hesitancy and anti-vaccination movements. The objective of this study is to evaluate COVID-19 vaccine acceptance among pregnant and lactating individuals in Maharashtra state, India.

MATERIALS AND METHODS: A descriptive cross-sectional study was conducted via a hybrid approach using various digital portals such as Whatsapp, telegram, and physical distribution to those who did not have access to smartphone devices. A probability proportional sampling strategy was deployed. A pre-validated structured self-administered questionnaire tool designed by Freeman *et al.* 2020 (Oxford COVID-19 vaccine hesitancy scale) was used, which consisted of seven close-ended targeted and focused questions. Analysis of several survey items and vaccine acceptance was conducted using the Chi-square test.

RESULTS: Analysis revealed that 58% of individuals were willing to take vaccines after government approval and 26% of individuals showed hesitancy toward vaccination. When compared, lactating individuals showed less vaccine hesitancy (22%) than pregnant individuals (27%). The maximum vaccine hesitancy was observed in the third trimester of pregnancy (29.5%).

CONCLUSIONS: Trust in vaccines is a crucial factor and is dependent on the ability of the government in promoting vaccines through effective communication; this can be one of the reasons for the high level of acceptance and awareness toward COVID-19 vaccination in this study.

Keywords:

Breastfeeding women, COVID-19, pandemics, population, pregnant women, public health, vaccines

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Introduction

COVID-19 has affected worldwide causing a global pandemic. The World Health Organization (WHO) declared the virus public health emergency of international concern on January 30, 2020, and later to pandemic on March 11, 2020.[1] Since the outbreak of the pandemic, release of the COVID-19 vaccine was anticipated by all. Vaccination has always been one of the important public health tools which limit the spread of infections, mortality, and hospitalization substantially. The vaccination drive started in India on January 16, 2021.[2] Vaccines approved initially were Covishield (Serum Institute of India Pvt Ltd) and Covaxin (Bharat Biotech, India), later Sputnik V (Russia), and Moderna were made available.[2] According to the Indian Council of Medical Research (ICMR), positive COVID-19 cases

after the second dose from Covishield were 0.03% and 0.04% for Covaxin, reducing the overall mortality rate.[3] Vaccination in India was carried out in a phasic manner, phase-1 included health care and frontline workers followed by people above 60 years of age, and those over 45 years with comorbidities were included in phase-2.[4] Phase-3 focused to cover all people more than 45 years of age. Phase-4 included individuals above 18 years of age.[4] According to the Ministry of Health and Family Welfare (MoHFW), 50.30% of the Indian adult population has received at least one dose while 15% of the Indian population is completely vaccinated.[5]

Vaccination has now expanded to include all citizens from 18 years of age onwards making about 69% of the Indian population eligible for vaccination out of which a significant proportion of 48% are women.[6] Government data reveals that, as far as the male-female ratio is concerned, women are left behind men by over 30 billion doses; 150 billion doses have been administered to women since the beginning of the vaccination drive, which is 46% of the total doses.[7] Several factors may be attributed toward ingraining vaccine hesitancy among females which include their perception that COVID-19 vaccines should not be taken during menstruation or that vaccine may cause infertility might be the reasons behind the skewed ratio.[8] The most common disbelief and mistrust regarding vaccination is driven by fear of the unknown.

The initial clinical trials did not include pregnant and lactating women; however, now the WHO recommends vaccination in pregnant women when the benefit of the vaccination outweighs the potential risk.[9] State has estimated that from the 20 lakh pregnant women, only around 40,700 women have been vaccinated, which is barely 2% of the population.[10] Mumbai is home to about 1.5 lakh pregnant women of which only 1,278 have taken the vaccine.[10] Even though similar to the influenza vaccination strategy, every vaccination Centre has a separate queue for pregnant and lactating women, but very less turnout is observed.[11] Although there's a scarcity of information available, preliminary data gathered has shown considerable evidence in favor of vaccination.[12] Nevertheless vaccine availability does not symbolize the end of the pandemic due to ongoing vaccine hesitancy and anti-vaccination movements.

Pregnant women when infected with COVID-19 are more likely to have complications when compared to non-pregnant women.[9] COVID-19 in pregnant women is also associated with preterm birth, admission in Neonatal Intensive Care Unit, and stillbirths due to a decrease in oxygen levels.(9) Pregnant women are at higher risk of getting infected, also the presence of comorbidities increases the potential risk during pregnancy.[9] The Federation of Obstetrics and Gynecology Societies of India (FOGSI) has recommended vaccination for pregnant women stating double protection for mothers as well as newborns.[13] WHO recommends vaccines to lactating mothers and endorses continued breastfeeding even after vaccination as breastfeeding has substantial benefits for both mothers as well as the baby.[9] Breastfeeding with proper precautions and hygiene is recommended even in suspected or confirmed cases of COVID-19 as the antibodies produced by the mother can be transferred to the child via breast milk.[13] Pregnant women constitute 5% of India's total population which forms a significant portion of the population, if vaccine skepticism develops in such a vulnerable population, then there will be a considerable decline in the overall vaccine acceptance rate in India.[14,15] In a thorough literature study on scientific portals, not a single study has been reported to elucidate vaccine acceptance among pregnant and lactating individuals. The purpose of this study is to estimate the frequency of COVID-19 vaccine acceptance and adherence among pregnant and lactating high-risk group individuals in Maharashtra State, India.

Materials and Methods

Study design and setting
A cross-sectional, descriptive type of study was conducted among pregnant and lactating individuals with a total sample size of 919 subjects in the state of Maharashtra, India.

Study participants and sampling
The Study participants consisted of 919 subjects (585 pregnant and 334 lactating).

The sample size was calculated based on a pilot study conducted among 50 study subjects (25 pregnant and 25 lactating). The G power statistical software (3.1.9.7.) was used to calculate the sample size of the study population which was discerned to be 1,075 individuals who were scheduled to be recruited in the final sample for the study. Type I error (α) =5%. Power of study (1-β) = 80% Subjects recruited in the pilot study did not constitute the final sample number.

Data collection tool and technique
The data collection tool, comprised of a pre-validated, structured, self-administered questionnaire tool designed by Freeman *et al*.[16] 2020 (Oxford COVID-19 vaccine hesitancy scale), was used, which consisted of seven close-ended targeted and focused questions. The tool originally available in the English language has been translated into the acceptable local languages (Hindi and Marathi) and was back-translated subsequently to check for appropriateness. The tool was administered

using a hybrid format channelizing it through digital portals (such as Whatsapp and telegram) via a dedicated google form and physical distribution to the same who did not have access to a smartphone device.

Probability proportional sampling was deployed. Subjects included were either pregnant (I, II, and III trimester) or currently lactating and were residents of Maharashtra state. The participants who did not give written informed consent or incompletely filled forms were excluded from the study.

The data from participants such as education, income, and professions were obtained, and based on this, socioeconomic status was calculated using Modified Kuppuswamy Socioeconomic Scale (updated for the year 2021). The study was conducted over a period of 4 months from February to May 2021 in six divisions of Maharashtra state.[17]

Figure 1 shows the entire methodological flow.

Ethical consideration

The current study was granted ethical approval from the Institutional Ethics Of Terna Dental College and Hospital (TDC/EC/20/2021).

Results

A total of 919 pregnant and lactating subjects aged between 19 and 50 years participated in the study from the state of Maharashtra, India. Of all respondents, 585 (63%) were pregnant and 334 (37%) were lactating individuals.

Among pregnant women, 147 (16.1%) were in the 1st trimester, 179 (20%) were in the 2nd trimester, and 257 (28%) were in the 3rd trimester [Figure 2]. When compared, pregnant women in their first trimester expressed greater interest in receiving the COVID-19 vaccination than others ($P < 0.05$) depicted in Table 1.

A total of 207 (22.5%) participants already had been infected with Coronavirus disease [Figure 3], and among them, 125 (60.3%) were most likely to accept vaccination if available, which is portrayed in Table 2. The socioeconomic status of participants is illustrated in Figure 4. Correlation between COVID-19 vaccine acceptance and their socioeconomic status is shown in Table 3, a high number of respondents belonged to the Upper Middle class, 349 (37.9%), and then lower middle class 319 (34.7%) acceptance rate of upper-middle was (57%) and lower middle class (51%) (p < 0.05). An overview shows a positive attitude toward COVID vaccine acceptance among pregnant and lactating individuals.
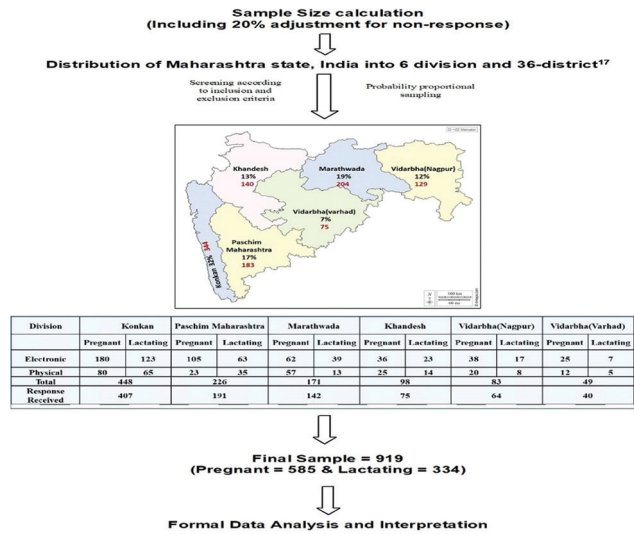
Figure 1: Sampling strategy and methodology framework
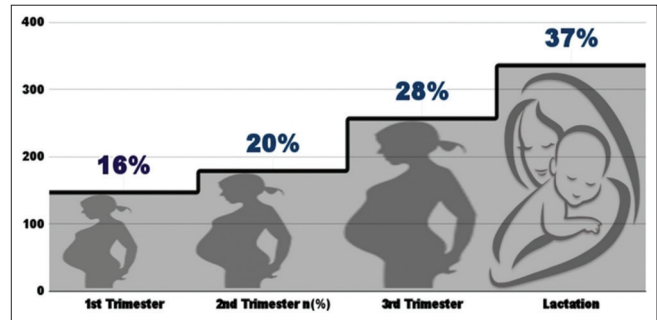
Figure 2: Distribution of study population (in months)
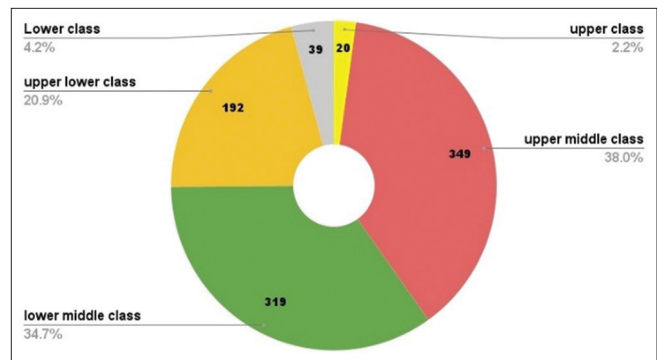
Figure 3: Socio-Economic Status of Pregnant and Lactating study population

Discussion

Vaccination plays a key role in controlling morbidity and mortality among vulnerable populations such as pregnant and lactating women.[13] Pregnant women are at high risk of exposure to COVID-19.[18] According to WHO, pregnant women when compared to non-pregnant women of the same reproductive age were more likely to have complications including those admitted to intensive care, needing invasive ventilation, and so on,

Table 1: Association between Responses of Oxford COVID-19 vaccine hesitancy scale andpPregnancy in months or lactation

Responses	Pregnancy in months or Lactation				Total	χ^2	P
	1st Trimester *n* (%)	2nd Trimester *n* (%)	3rd Trimester *n* (%)	Lactation *n* (%)			
Would you take a COVID-19 vaccine (approved for use by the government) if offered?							
Definitely	47 (32.0)	43 (24.0)	65 (25.3)	113 (33.6)	267 (29.1)	48.143(a)	0.004*
Probably	39 (26.5)	63 (35.2)	78 (30.4)	84 (25.0)	265 (28.8)		
I may or I may not	21 (14.3)	20 (11.2)	33 (12.8)	57 (17.0)	131 (14.5)		
Probably not	26 (17.7)	27 (15.1)	22 (8.6)	25 (7.4)	100 (10.9)		
Definitely not	9 (6.1)	22 (12.3)	54 (21.0)	50 (14.9)	135 (14.7)		
Do not know	5 (3.4)	4 (2.2)	5 (1.9)	7 (2.1)	21 (2.3)		
If there is a COVID-19 vaccine available							
I will want to get it as soon as possible	46 (31.3)	47 (26.3)	60 (23.3)	112 (33.3)	265 (28.8)	38.990(a)	0.037*
I will take it when offered	41 (27.9)	47 (26.3)	86 (33.5)	104 (31.0)	278 (30.3)		
I'm not sure what I will do	19 (12.9)	35 (19.6)	29 (11.3)	56 (16.6)	139 (15.1)		
I will put off (delay) getting it	27 (18.4)	23 (12.8)	48 (18.7)	40 (12.0)	138 (15.0)		
I will refuse to get it	8 (5.4)	24 (13.4)	26 (10.1)	19 (5.7)	77 (8.4)		
Do not know	6 (4.1)	3 (1.7)	8 (3.1)	5 (1.4)	22 (2.4)		
I would describe my attitude toward receiving a COVID-19 vaccine as							
Very keen	34 (23.1)	17 (9.5)	30 (11.7)	57 (16.9)	138 (15.0)	51.945(a)	0.001*
Pretty positive	37 (25.2)	71 (39.7)	108 (42.0)	140 (41.7)	356 (38.7)		
Neutral	32 (21.8)	36 (20.1)	46 (17.9)	43 (12.8)	157 (17.1)		
Quite uneasy	35 (23.8)	28 (15.6)	48 (18.7)	62 (18.5)	173 (18.8)		
Against it	5 (3.4)	16 (8.9)	21 (8.2)	28 (8.3)	70 (7.6)		
Do not know	4 (2.7)	11 (6.1)	4 (1.6)	6 (1.8)	25 (2.7)		
If a COVID-19 vaccine was available at my local hospital or vaccination center, I would							
Get it as soon as possible	46 (31.3)	50 (27.9)	61 (23.7)	113 (33.6)	138 (15.0)	29.527 (a)	0.242
Get it when I have time	35 (23.8)	42 (23.5)	89 (34.6)	99 (29.5)	356 (38.7)		
Delay getting it	26 (17.7)	33 (18.4)	32 (12.5)	33 (9.8)	157 (17.1)		
Avoid getting it for as long as possible	29 (19.7)	35 (19.6)	49 (19.1)	68 (20.2)	173 (18.8)		
Never get it	7 (4.8)	10 (5.6)	17 (6.6)	17 (5.1)	70 (7.6)		
Do not know	4 (2.7)	9 (5.0)	9 (3.5)	6 (1.8)	25 (2.7)		
If my family or friends were thinking of getting a COVID-19 vaccination, I							
Strongly encourage them	50 (34.0)	48 (26.8)	67 (26.1)	101 (30.4)	270 (29.4)	21.774 (a)	0.649
Encourage them	38 (25.9)	65 (36.3)	80 (31.1)	105 (31.5)	265 (28.8)		
Not say anything to them about it	19 (12.9)	21 (11.7)	30 (11.7)	38 (11.3)	124 (13.5)		
Ask them to delay getting the vaccination	26 (17.7)	22 (12.3)	49 (19.1)	41 (12.2)	181 (19.7)		
Suggest that they do not get the vaccination	11 (7.5)	20 (11.2)	21 (8.2)	34 (10.1)	51 (5.5)		
Do not know	3 (2.0)	3 (1.7)	10 (3.9)	15 (4.4)	28 (3.0)		
I would describe myself as							
Eager to get a COVID-19 vaccine	34 (23.1)	30 (16.8)	35 (13.6)	63 (19.0)	163 (17.7)	66.537 (a)	<0.001*
Willing to get the COVID-19 vaccine	53 (36.1)	66 (36.9)	116 (45.1)	160 (47.6)	395 (43.0)		
Not bothered about getting the COVID-19 vaccine	24 (16.3)	26 (14.5)	20 (7.8)	35 (10.4)	105 (11.4)		
Unwilling to get the COVID-19 vaccine	24 (16.3)	34 (19.0)	63 (24.5)	58 (17.3)	179 (19.5)		
Anti-vaccination for COVID-19	5 (3.4)	7 (3.9)	10 (3.9)	12 (3.9)	35 (3.8)		
Do not know	7 (4.8)	16 (8.9)	13 (5.1)	6 (1.8)	42 (4.6)		
Taking a COVID-19 vaccination is							
Really important	37 (25.2)	45 (25.1)	62 (24.1)	93 (28.0)	238 (25.9)	22.481 (a)	0.608
Important	56 (38.1)	60 (33.5)	97 (37.7)	121 (36.3)	335 (36.5)		
Neither important nor unimportant	17 (11.6)	28 (15.6)	19 (7.4)	37 (11.0)	101 (11.0)		

Contd...

Table 1: Contd...

Responses	Pregnancy in months or Lactation				Total	χ^2	P
	1st Trimester *n* (%)	2nd Trimester *n* (%)	3rd Trimester *n* (%)	Lactation *n* (%)			
Unimportant	19 (12.9)	23 (12.8)	46 (17.9)	58 (17.3)	146 (15.9)		
Really unimportant	9 (6.1)	13 (7.3)	15 (5.8)	10 (3.0)	47 (5.1		
Do not know	9 (6.1)	10 (5.6)	18 (7.0)	15 (4.4)	52 (5.7)		
Total	147 (100.0)	179 (100.0)	257 (100.0)	336 (100.0)	919 (100.0)		

Chi-square (χ^2) test of association applied. *P<0.05 indicates statistical significance
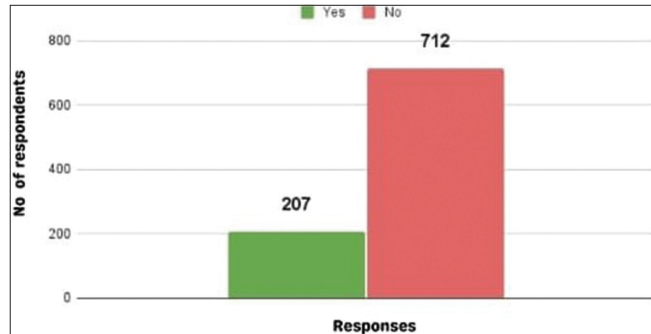

Figure 4: Covid-19 History of pregnant and lactating study population

when infected with COVID-19.[9] It is perceived that COVID-19 infection during pregnancy may lead to rapid deterioration of the health of pregnant women and could also affect the fetus.[9] Zeng L *et al*.[19] demonstrated that 3 out of 33 neonates born to mothers with active infection with COVID-19 infection were likely to show a chance of vertical transmission. Vaccination in such a vulnerable population acts as a medical intervention to prevent the spread of infection, thereby preventing the disease in a simple and effective way. This study is the first attempt and serves as a capstone project for understanding the acceptance of the COVID-19 vaccines among pregnant and lactating individuals in the state of Maharashtra, India.

Analysis revealed that even after government approval, 26% of pregnant and lactating women showed vaccine hesitancy and 58% of individuals were willing to take COVID-19 vaccine. When compared, lactating individuals showed less vaccine hesitancy (22%) than pregnant individuals (27%). The maximum hesitancy was seen in the third trimester of pregnancy 29.5% and the results are significant (P < 0.05). Congruent findings were reported in a survey conducted by Skjefte M *et al*.[20] which compared pregnant women of 16 different countries. It showed that vaccine acceptance in India is more than 80% in contrast to other countries such as USA, Australia, and Russia which comparatively showed less vaccine acceptance 45%. Similar results were seen in a study conducted by Mohan S *et al*.[21] which showed a 25% of vaccine hesitancy rate among perinatal women of Qatar. COVID-19 vaccine acceptance in pregnant women varies worldwide ranging fro- China (77%), Turkey (37%), to Singapore (30%).

The study revealed that 48% of the participants had an intention to be vaccinated against COVID-19 when the vaccine will be made available in Maharashtra state, India (P < 0.05). However, Hailemariam S *et al*.[22] in Ethiopia reported contrasting results (31.3%). Comparable findings were seen in a study conducted in Jordan (28.4%), the Middle East (36.8%), and Turkey (37%).[22]

When participants were asked to describe their attitude toward COVID-19 vaccination, 163 (17.7%) were eager to be vaccinated and 395 (43.0%) were willing, whereas 179 (19.5%) were unwilling to get vaccinated, 35 (3.8%) described themselves as explicitly anti-vaccination for COVID-19. And 147 (16%) participants do not endorse any clear response on vaccination (P < 0.05). A previously reported study by Jayagobi P *et al*.[23] in Singapore showed (30%) pregnant and (17%) lactating individuals were willing to take COVID vaccine.

Previous studies have shown vaccine affordability as an influential barrier for implementation and uptake of the vaccine.[24] According to a study conducted by Lois Privor-Dumm, when compared to the other two countries, Italy and Spain, India had more frequently reported the cost of maternal vaccines as the main barrier for adopting and implementing new vaccines.[24] However, in this study, vaccine acceptance was high in the lower class (72%) followed by upper-middle (57%) and lower-middle class (51%) (P < 0.05). This high acceptance of vaccination can be due to government efforts such as providing free vaccines at government hospitals and several non-profit organizations (P < 0.01).

Women in the current study who were in their first and third trimesters relatively expressed greater interest in receiving the COVID-19 vaccination than the second trimester (P < 0.01). This was similar to the findings reported by Ayhan S.G *et al*.[25] wherein women in their first trimester relatively expressed greater interest in receiving the COVID-19 vaccination than in other trimesters (P < 0.05).

In India, the Federation of Obstetric and Gynecological Societies of India (FOGSI) and the National Technical Advisory Group on Immunization (NTAGI) have recommended that pregnant women may be offered

Table 2: Association between Responses of Oxford COVID-19 vaccine hesitancy Scale and Previous COVID-19 History

Questions	Options	COVID-19 history		Total	χ^2	P
		Yes	No			
Would you take a COVID-19 vaccine (approved for use by the government) if offered?	Definitely	51 (24.6)	216 (30.3)	267 (29.1)	12.740 (a)	0.026*
	Probably	67 (32.4)	198 (27.8)	265 (28.8)		
	I may or I may not	36 (17.4)	95 (13.3)	131 (14.3)		
	Probably not	29 (14.0)	71 (10.0)	100 (10.9)		
	Definitely not	19 (9.2)	116 (16.3)	135 (14.7)		
	Do not know	5 (2.4)	16 (2.2)	21 (2.3)		
If there is a COVID-19 vaccine available:	I will want to get it as soon as possible	56 (27.1)	209 (29.4)	265 (28.8)	17.805 (a)	0.003*
	I will take it when offered	69 (33.3)	209 (29.4)	278 (30.3)		
	I'm not sure what I will do	43 (20.8)	96 (13.5)	139 (15.1)		
	I will put off (delay) getting it	17 (8.2)	121 (17.0)	138 (15.0)		
	I will refuse to get it	20 (9.7)	57 (8.0)	77 (8.4)		
	Do not know	2 (1.0)	20 (2.8)	22 (2.4)		
I would describe my attitude towards receiving a COVID 19 vaccine as:	Very keen	38 (18.4)	100 (14.0)	138 (15.0)	16.987 (a)	0.005*
	Pretty positive	79 (38.2)	277 (38.9)	356 (38.7)		
	Neutral	49 (23.7)	108 (15.2)	157 (17.1)		
	Quite uneasy	27 (13.0)	146 (20.5)	173 (18.8)		
	Against it	11 (5.3)	59 (8.3)	70 (7.6)		
	Do not know	3 (1.4)	22 (3.1)	25 (2.7)		
If a COVID-19 vaccine was available at my local hospital or vaccination center, I would:	Get it as soon as possible	62 (30.0)	208 (29.2)	138 (15.0)	12.080 (a)	0.034*
	Get it when I have time	65 (31.4)	200 (28.1)	356 (38.7)		
	Delay getting it	38 (18.4)	86 (12.1)	157 (17.1)		
	Avoid getting it for as long as possible	31 (15.0)	150 (21.1)	173 (18.8)		
	Never get it	6 (2.9)	45 (6.3)	70 (7.6)		
	Do not know	5 (2.4)	23 (3.2%)	25 (2.7)		
If my family or friends were thinking of getting a COVID-19 vaccination, I	Strongly encourage them	52 (25.1)	215 (30.2)	270 (29.4)	5.331 (a)	0.377
	Encourage them	78 (37.7)	211 (29.6)	265 (28.8)		
	Not say anything to them about it	24 (11.6)	84 (11.8)	124 (13.5)		
	Ask them to delay getting the vaccination	30 (14.5)	108 (15.2)	181 (19.7)		
	Suggest that they do not get the vaccination	17 (8.2)	69 (9.7)	51 (5.5)		
	Do not know	6 (2.9)	25 (3.5)	28 (3.0)		
I would describe myself as	Eager to get a COVID-19 vaccine	40 (19.3)	123 (17.3)	163 (17.7)	7.237 (a)	0.204
	Willing to get the COVID-19 vaccine	94 (45.4)	301 (42.3)	395 (43.0)		
	Not bothered about getting the COVID-19 vaccine	29 (14.0)	76 (10.7)	105 (11.4)		
	Unwilling to get the COVID-19 vaccine	29 (14.0)	150 (21.1)	179 (19.5)		
	Anti-vaccination for COVID-19	8 (3.9)	27 (3.8)	35 (3.8)		
	Do not know	7 (3.4)	35 (4.9)	42 (4.6)		
Taking a COVID-19 vaccination is	Really important	50 (24.2)	188 (26.4)	238 (25.9)	10.256 (a)	
	Important	91 (44.0)	244 (34.3)	335 (36.5)		0.068*
	Neither important nor unimportant	25 (12.1)	76 (10.7)	101 (11.0)		
	Unimportant	22 (10.6)	124 (17.4)	146 (15.9)		
	Really unimportant	8 (3.9)	39 (5.5)	47 (5.1)		
	Do not know	11 (5.3)	41 (5.8)	52 (5.7)		
	Total	207 (100.0)	712 (100.0)			

Chi-square (χ^2) test of association applied. *$P<0.05$ indicates statistical significance

the choice to receive any COVID-19 vaccine.[26] Analysis revealed that 22.5% of women had previously tested positive for coronavirus, of which 57% showed a positive response toward COVID vaccination; however, 17.4% could not make a decision and 23.2% showed hesitancy for the vaccination even after government approval.

The year 2020 was dominated by the spread of COVID-19 across the globe, putting normal life on hold, and 2021 has so far focused on ending the pandemic by vaccination.[27] Trust in vaccines is a crucial factor and is dependent on the ability of the government in promoting vaccines through effective communication.[28] The Government of India is taking all the necessary measures to ensure that the entire population is vaccinated.[28] The Government implied various mass approaches such as television and radio advertisement, posters, hoardings, announcements in local trains, caller tunes, and so on, and mobile

Table 3: Association between Responses of Oxford COVID-19 vaccine hesitancy Scale and Socio-economic Status

Question	Responses	Socioeconomic status					Total	χ^2	P
		Upper class	Upper middle class	Lower middle class	Upper lower class	Lower class			
Would you take a COVID-19 vaccine (approved for use by the government) if offered?	Definitely	12 (60.0)	116 (33.2)	45 (14.1)	74 (38.5)	20 (51.3)	267 (29.1)	100.200 (a)	<0.001*
	Probably	1 (5.0)	84 (24.1)	117 (36.7)	55 (28.6)	8 (20.5)	265 (28.8)		
	I may or I may not	2 (10.0)	44 (12.6)	44 (13.8)	34 (17.7)	7 (17.9)	131 (14.3)		
	Probably not	2 (10.0)	35 (10.0)	46 (14.4)	16 (8.3)	1 (2.6)	100 (10.9)		
	Definitely not	2 (10.0)	63 (18.1)	61 (19.1)	6 (3.1)	3 (7.7)	135 (14.7)		
	Do not know	1 (5.0)	7 (2.0)	6 (1.9)	7 (1.9)	0 (0.0)	21 (2.3)		
If there is a COVID-19 vaccine available:	I will want to get it as soon as possible	12 (60.0)	97 (27.8)	53 (16.6)	83 (43.2)	20 (51.3)	265 (28.8)	96.999 (a)	<0.001*
	I will take it when offered	2 (10.0)	109 (31.2)	102 (32.0)	58 (30.2)	7 (17.9)	278 (30.3)		
	I'm not sure what I will do	2 (10.0)	50 (14.3)	51 (16.0)	29 (15.1)	7 (17.9)	139 (15.1)		
	I will put off (delay) getting it	1 (5.0)	54 (15.5)	71 (22.3)	11 (5.7)	1 (2.6)	138 (15.0)		
	I will refuse to get it	3 (15.0)	31 (8.9)	36 (11.3)	3 (1.6)	4 (10.3)	77 (8.4)		
	Do not know	0 (.0)	8 (2.3)	6 (1.9)	8 (4.2)	0 (.0)	22 (2.4)		
I would describe my attitude towards receiving a COVID 19 vaccine as:	Very keen	7 (35.0)	63 (18.1)	15 (4.7)	34 (17.7)	19 (48.7)	138 (15.0)	101.227 (a)	<0.001*
	Pretty positive	7 (35.0)	136 (39.0)	119 (37.3)	87 (45.3)	7 (17.9)	356 (38.7)		
	Neutral	6 (30.0)	47 (13.5)	63 (19.7)	36 (18.8)	5 (12.8)	157 (17.1)		
	Quite uneasy	0 (.0)	69 (19.8)	80 (25.1)	20 (10.4)	4 (10.3)	173 (18.8)		
	Against it	0 (.0)	23 (6.6)	32 (10.0)	11 (5.7)	4 (10.3)	70 (7.6)		
	Do not know	0 (.0)	11 (3.2)	10 (3.1)	4 (2.1)	0 (.0)	25 (2.7)		
If a COVID-19 vaccine was available at my local hospital or vaccination center, I would:	Get it as soon as possible	12 (60.0)	112 (32.1)	53 (16.6)	71 (37.0)	22 (56.4)	138 (15.0)	91.777 (a)	<0.001*
	Get it when I have time	2 (10.0)	98 (28.1)	103 (32.3)	59 (30.7)	3 (7.7)	356 (38.7)		
	Delay getting it	2 (10.0)	52 (14.9)	41 (12.9)	25 (13.0)	4 (10.3)	157 (17.1)		
	Avoid getting it for as long as possible	3 (15.0)	67 (19.2)	89 (27.9)	19 (9.9)	3 (7.7)	173 (18.8)		
	Never get it	1 (5.0)	13 (3.7)	26 (8.2)	7 (3.6)	4 (10.3)	70 (7.6)		
	Do not know	0 (0)	7 (2.0)	7 (2.2)	11 (5.7)	3 (7.7)	25 (2.7)		
If my family or friends were thinking of getting a COVID-19 vaccination, I	Strongly encourage them	16 (80.0)	100 (28.7)	50 (15.7)	75 (39.1)	26 (66.7)	270 (29.4)	110.836 (a)	<0.001*
	Encourage them	3 (15.0)	112 (32.1)	106 (33.2)	61 (31.8)	7 (17.9)	265 (28.8)		
	Not say anything to them about it	0 (.0)	47 (13.5)	40 (12.5)	21 (10.9)	0 (0)	124 (13.5)		
	Ask them to delay getting the vaccination	0 (0)	57 (16.3)	60 (18.8)	20 (10.4)	1 (2.6)	181 (19.7)		
	Suggest that they do not get the vaccination	1 (5.0)	24 (6.9)	45 (14.1)	11 (5.7)	5 (12.8)	51 (5.5)		
	Do not know	0 (0)	9 (2.6)	18 (5.6)	4 (2.1)	0 (0)	28 (3.0)		
I would describe myself as	Eager to get a COVID-19 vaccine	7 (35.0)	66 (18.9)	26 (8.2)	48 (25.0)	16 (41.0)	163 (17.7)	88.121 (a)	<0.001*
	Willing to get the COVID-19 vaccine	8 (40.0)	148 (42.4)	140 (43.9)	89 (46.4)	10 (25.6)	395 (43.0)		
	Not bothered about getting the COVID-19 vaccine	0 (0)	38 (10.9)	40 (12.5)	26 (13.5)	1 (2.6)	105 (11.4)		
	Unwilling to get the COVID-19 vaccine	3 (15.0)	76 (21.8)	83 (26.0)	12 (6.3)	5 (12.8)	179 (19.5)		
	Anti-vaccination for COVID-19	0 (0)	12 (3.4)	15 (4.7)	4 (2.1)	4 (10.3)	35 (3.8)		
	Do not know	2 (10.0)	9 (2.6)	15 (4.7)	13 (6.8)	3 (7.7)	42 (4.6)		

Contd...

Table 3: Contd...

Question	Responses	Socioeconomic status						Total	χ^2	P
		Upper class	Upper middle class	Lower middle class	Upper lower class	Lower class				
Taking a COVID-19 vaccination is	Really important	15 (75.0)	92 (26.4)	40 (12.5)	69 (35.9)	22 (56.4)(		238 (25.9)	111.675 (a)	<0.001*
	Important	4 (20.0)	129 (37.0)	122 (38.2)	70 (36.5)	10 (25.6)		335 (36.5)		
	Neither important nor unimportant	1 (5.0)	40 (11.5)	37 (11.6)	23 (12.0)	0 (0)		101 (11.0)		
	Unimportant	0 (.0)	57 (16.3)	77 (24.1)	11 (5.7)	1 (2.6)		146 (15.9)		
	Really unimportant	0 (0)	15 (4.3)	22 (6.9)	7 (3.6)	3 (7.7)		47 (5.1)		
	Do not know	0 (0)	16 (4.6)	21 (6.6)	12 (6.3)	3 (7.7)		52 (5.7)		
Total		20 (100.0)	349 (100.0)	319 (100.0)	192 (100.0)	39 (100.0)		919 (100.0)		

Chi-square (χ^2) test of association applied. *$P<0.05$ indicates statistical significance.

applications such as Arogya Setu and CoWIN.[8] The entire vaccine supply line has been digitized through an Electronic Vaccine Intelligence Network (eVIN).[29] The COVID-19 vaccine rollout itself is being monitored through a digital COVID-19 vaccine intelligence network (Co-WIN) that helps in planning, implementing, monitoring, and evaluating the campaign.[8] Analyses reported by Kaur TP *et al*. have shown a high vaccine acceptance rate in India at 86%, which is in agreement with this study conducted among pregnant and lactating women in Maharashtra state.[30] The significant vaccine uptake was due to various government efforts such as counseling sessions organized by local bodies, public figures, ASHA workers, and each vaccination center has a special queue for pregnant women. The government also adopted innovative ways to encourage them, for instance, certificates, issued by deputy commissioners, to those pregnant and lactating women who were the first to get themselves vaccinated resulted in building confidence and acceptance in the community.

Limitation and recommendation

To the best of our knowledge, this is one of the initial studies providing insight into COVID-19 vaccine acceptance and adherence among pregnant and lactating women in Maharashtra state, India. The questionnaire had been designed by Oxford and it evaluated the hesitancy toward COVID-19 vaccination. This study was specific to the vulnerable population, pregnant and lactating individuals, and hence, data might be helpful in formulating health policies targeting this sub-population. Due to evolving evidence on this topic, answers to the questionnaire may change with time. Furthermore, it is a single-state study and may not be generalized to the entire population of the country. As India is battling against coronavirus disease and in the absence of a definitive cure, strengthening of health policies directed at pregnant and lactating women should be prioritized.

Conclusion

COVID-19 vaccines have been through all the required stages of clinical trials, and extensive testing and monitoring have shown that these vaccines are safe and effective. One can resume their daily routine after they are fully vaccinated. The Government of India is taking all the necessary measures to ensure vaccination for all. COVID vaccines are recommended for women who are pregnant, breastfeeding, trying to get pregnant now, or might become pregnant in the future. This study demonstrated that the majority of pregnant and lactating women had a positive attitude toward getting COVID-19 vaccination. Pregnant and lactating individuals constitute a significant amount of the population, and getting them vaccinated is essential to hasten the end of this deadly pandemic.

Acknowledgments

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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