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Coronavirus Pandemic

Acceptance and hesitancy towards COVID-19 vaccines in rural and tribal areas of Maharashtra (India)

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Abstract

Introduction: Hesitancy towards COVID-19 vaccines may be a major hindrance to a successful vaccination program. We assessed the vaccine uptake, facilitators, and barriers for the COVID-19 vaccine in tribal and rural populations in Maharashtra, India.

Methodology: The present study is a cross-sectional analysis of data collected from 373 individuals from six villages (three tribal and three rural) from August 2022 to September 2022. Demographic information, COVID-19 history, details about vaccination, and reasons for taking/not taking the vaccine were collected.

Results: In these individuals, 236 (63.3%) had taken two doses, 85 (22.8%) had taken one dose, and 52 (13.9%) had not taken the vaccine. Tribal villagers were less likely to have completed vaccination (50.7% vs 79.3%; $p < 0.001$). Males were more likely to state 'compulsory at my workplace' (27.7% vs 7.7%; $p < 0.001$), whereas females were more likely to report 'could not get ration food without it' (52.7% vs 31.5%; $p < 0.001$) as the reason for vaccination. Common reasons for not taking the vaccine were: fear of side effects (56%); no need for vaccination (41.2%); do not trust the vaccines (40%); and 'there is no such thing as COVID-19'(16%). A majority (94.7%) had completed COVID-19 vaccination at government vaccination centers.

Conclusions: Tribal villagers, women, and those from lower socioeconomic status were less likely to have taken the vaccine. Fear about side effects and mistrust about vaccines were the main reasons for not having taken the vaccine. Addressing these issues in mass information campaigns may help improve vaccination coverage.

Key words: COVID-19 vaccination; acceptance; hesitancy; tribal; rural areas.

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Introduction

The initial cases of atypical pneumonia in December 2019 in the Wuhan province of China are considered to be the first signs of an emerging new infectious pandemic [1]. It was in March 2020, that the World Health Organization (WHO) declared it to be a global pandemic and COVID-19 to be an infection of concern that had spread to many parts of the world [2]. Vaccination against COVID-19 has become an important intervention globally. Some of the main categories of these vaccines are: mRNA vaccines, DNA vaccines, protein subunit vaccines, viral vector type vaccines – replicating and non-replicating, inactivated virus, and live attenuated virus [3]. India started the vaccination program on January 16, 2021; the initial focus was on high-risk groups such as medical workers and other frontline workers (WHO Reference) followed by the general population. The two main vaccines used during the initial days of vaccination were Covishield ™ and Covaxin ® [4-6]. Some of the other vaccines that were also added to the list are Sputnik V, ZyCoV- D, Corbevax, and Covovax (Cowin) [7,8].

Vaccine hesitancy for COVID-19 vaccines may be a major hindrance to a successful global vaccination program. It is quite likely that there may be hesitancy in taking a relatively new vaccine (such as the COVID-19 one); however, the acceptance of the vaccine may improve over time (due to increased awareness, knowledge, and data about the vaccine) [9]. Some of the factors that influence decisions about taking a vaccine are knowledge, perceived importance, personal and religious beliefs, past experience, policy about vaccination, the role of healthcare workers, and the role of media [10]. A recent systematic review found that

the acceptance of COVID-19 vaccines was as low as 27.7% to as high as 78.1% among healthcare workers [11]. Jain *et al.* found vaccine hesitancy to be about 10.6% in medical students in India [12]. Hesitancy in these medical students was significantly associated with concerns about efficacy or adverse events, lack of knowledge about the eligibility criteria, and lack of trust in the public health authorities or government [12].

Globally, the vaccine acceptability in the general population ranged from 28.4% to 97.0%. A global survey by Lazarus *et al.* reported that 74.5% were willing to take the COVID-19 vaccine in India [13]. However, factors such as gender, employment status, ethnic minority status, and living in a rural area may be associated with vaccine hesitancy [14,15]. Indeed, authors have highlighted the need for boosting COVID-19 vaccine uptake in indigenous people [16]. Indian studies have explored the reasons for a low vaccination rate (COVID-19 and others) in rural and tribal populations. Some of the factors associated with low vaccine coverage in tribal areas were socioeconomic status (SES), place of delivery, religion, and availability of a vaccination card [17]. For instance, Karpaga *et al.* found that the absence of a vaccination card on the day of vaccination was a hindrance to vaccine coverage – particularly in the vulnerable population [17]. Another study comparing the tribal and rural populations found that the coverage was lower in the rural population compared with the tribal population; dissatisfaction with services was an important reason for low vaccine coverage in the rural areas [18]. Thus, it is likely that the reasons for vaccine hesitancy may differ in tribal and rural populations in India; it will be important to understand the reasons in both these groups.

With this background, we designed the present study to assess the facilitators and barriers for COVID-19 vaccine hesitancy in tribal and rural populations in Maharashtra. We also wanted to evaluate the factors associated with vaccine uptake in these groups.

Methodology

The present study is a cross-sectional analysis of data collected from 373 individuals from August 2022 to September 2022.

Study site and participants

The study was conducted in six villages (three were classified as tribal and three as rural) in the Raigad district of Maharashtra, India. The Rural Health Training Centre (RHTC) of MGM Medical College and Hospital is located at the Primary Health Centre (PHC), Nere, Taluka Panvel of Raigad District in Maharashtra. The RHTC is primarily responsible for outreach activities including rural and tribal health training for undergraduate and postgraduate students. It conducts health surveys, camps, and health education programs for the benefit of the population that is covered under the catchment area. Though these villages are a part of the PHC at Nere, they are far from each other and separated by hilly terrain. There is a variation in demography, literacy, and occupation patterns in these villages. Rural villages have better road connectivity; hence, the population can travel to cities for jobs. However, the tribal villages are situated at a higher altitude on the hills; the population may not have access to modern modes of communication such as internet and cellular networks. They often do not prefer to leave their habitats situated in remote locations. We collected data from: a) three tribal villages (total 209): Dhamani (47); Dhodhani (106); and Gadheshwar (56); and b) three villages (total 164): Waje (57), Ritghar (48), and Nere (59), which were non-tribal (referred to as rural villages in this manuscript). This study is a part of a larger study that involves qualitative data collection about vaccine attitudes, behaviors, and the development of interventions for enhancing COVID-19 vaccination in rural and tribal populations in Maharashtra, India. For this quantitative component, we included adults (18 years and above) from the above-mentioned villages.

Study procedures

We included a consecutive consenting sample of individuals in these six villages. We administered an interviewer-administered questionnaire to the study participants and collected the following information: 1) demographic information (age, gender, socio-economic status (SES) based on Udai Pareekh scale [19]); 2) COVID-19 history (whether they or anyone in their family had COVID-19 and hospitalization/death in the family); 3) details about vaccination (doses taken, type of vaccine, where they got the vaccine, and payment for the vaccine). Those who had taken at least one dose of the vaccine, were asked to explain the reasons for taking the vaccine, and those who had not, were asked to point out the reasons for not taking the vaccine. The statements/reasons in the questionnaire were based on available literature, discussion with the community members, and pilot testing of the initial questionnaire. Individuals in the study had to respond to each statement/reason and their responses were listed as yes/no/don't know. Problems due to lack of personal identification documents were also collected (as another reason) in the quantitative component and explored in detail in the qualitative part of the study.

Complete vaccination was considered as two doses of the vaccine (according to the recommendations). Partial vaccination was considered as only one dose (of the recommended two doses) and those who had not taken even a single dose of the vaccine were considered as 'unvaccinated'.

Statistical methods

We estimated the mean and standard deviation (SD) for the linear variables (such as age) and proportions for the categorical variables (such as gender, and responses to the COVID-19 vaccine). The means were compared using the t-test and the proportions were compared using the chi-square test or Fisher's exact test for low expected cell counts. We then used the logistic regression models with cluster effects to identify the factors associated with complete vaccination in this group. We included age, gender, SES, area of residence (rural/tribal), and previous history of COVID-19 as variables in this logistic model. A p value of < 0.05 was considered statistically significant. Data were analyzed using Stata version 17 (© StataCorp, College Station, Texas, USA).

The study was approved by the Institutional Ethics Committee of MGM HIS (Reference no: MGMIHS/RES./02/2021-22/124.

Results

In our study, 236 individuals (63.3%) had taken two doses, 85 (22.8%) had taken one dose, and 52 (13.9%) had not taken any dose of the vaccine. The mean age (SD) of the participants was 38.3 (14.3) years; it was not significantly different between those who had completed the vaccination and those who had not (37.5 [13.8] vs 39.8 [15.1]; $p = 0.12$). Even though males were more likely to have taken two doses compared with females, the difference in proportion was not statistically significant (68% vs 60.1%; $p = 0.29$). Individuals who were classified as middle class were significantly more likely to have completed the vaccination compared with those in the lower middle or lower class (Table 1). People in the tribal villages were significantly less likely to have completed the vaccination compared with those in other rural villages (50.7% vs 79.3%; $p < 0.001$). There was a significant difference across these villages: Nere had the highest proportion of complete vaccination and Dhamani had the lowest. The most common side effects post-vaccination as reported by them were fever (32.8%), body aches (29.2%), and headache (10.9%). We have presented detailed information about vaccination status in Table 1. In our study population, only 2.9% (11) had reported COVID-19 infection; of these, six were

Table 1. Table showing the factors associated with complete, partial, and no vaccination for COVID-19 vaccines in 373 individuals from rural and tribal regions of Maharashtra, India.

Characteristics	Total	Complete	Partial	Unvaccinated	*p* value
Total	373 (100.0)	236 (63.3)	85 (22.8)	52 (13.9)	
Age groups					
18-29	124 (33.3)	84 (67.7)	24 (19.4)	16 (12.9)	0.499
30-49	157 (42.1)	98 (62.4)	40 (25.3)	19 (12.1)	
50-64	73 (19.6)	45 (61.6)	16 (21.9)	12 (16.4)	
≥ 65	19 (5.1)	9 (47.4)	5 (26.3)	5 (26.3)	
Gender					
Female	223 (59.8)	134 (60.1)	56 (25.1)	33 (14.8)	0.287
Male	150 (40.2)	102 (68.0)	29 (19.3)	19 (12.7)	
Socio economic status					
Lower	40 (10.7)	20 (50.0)	12 (30.0)	8 (20.0)	0.001
Lower middle	295 (79.8)	182 (61.8)	72 (24.4)	41 (13.9)	
Middle	38 (10.2)	34 (89.5)	1 (2.6)	3 (7.9)	
Type of residence					
Rural	164 (43.9)	130 (79.3)	23 (14.1)	11 (6.7)	< 0.001
Tribal	209 (56.1)	106 (50.7)	62 (29.7)	41 (19.6)	
Village					
Dhamani	47 (12.6)	14 (29.8)	20 (42.5)	13 (27.6)	< 0.001
Dhodani	106 (28.4)	49 (46.3)	32 (30.2)	25 (23.6)	
Gadheshwar	56 (15.1)	43 (76.8)	10 (17.8)	3 (5.4)	
Nere	59 (15.8)	52 (88.2)	2 (3.4)	5 (8.5)	
Ritghar	48 (12.8)	41 (85.4)	6 (12.5)	1 (2.1)	
Waje	57 (15.3)	37 (64.9)	15 (26.3)	5 (8.7)	
Previous Covid-19 infections					
Don't know	1 (0.3)	0 (0)	0 (0)	1 (100)	0.208
No	361 (96.8)	227 (62.8)	84 (23.3)	50 (13.8)	
Yes	11 (2.9)	9 (81.8)	1 (9.1)	1 (9.1)	

hospitalized. In addition, 3.7% (12) reported that their family members had COVID-19 infection; of these, one family member had died.

The most common reasons for taking the vaccine were: 1) to protect myself from COVID-19 (74.8%); 2) to protect the society (64.3%); 3) it was the right thing to do (55.5%); 4) I was not able to access services (such as bus/train) without the vaccine (46.1%); 5) I could not get ration food (subsidized scheme) without it (43.9%); and 6) it was compulsory at my place of work (16.1%). A significantly higher proportion of men in the age group of 30-49 years reported that they took the vaccine because they could not get access to bus/train services. Males were significantly more likely to state 'compulsory at my workplace' compared with females (27.7% vs 7.7%; $p < 0.001$); whereas females were significantly more likely to report 'could not get ration food without it' as the reason (52.7% vs 31.5%; $p < 0.001$). A significantly higher proportion of individuals belonging to the middle SES stated 'compulsory at my place of work' as the reason for taking the vaccine compared with others. However, 'could not get ration food' was reported more by individuals belonging to lower SES. A majority of these individuals (94.7%) had taken their vaccines in a government vaccination center. Covishield™ (27.1%) was commonly used followed by Covaxin® (11.5%) (the two most commonly used vaccines in India); however, a majority of them did not know about the type of vaccine they had taken. Detailed proportions according to age, gender, SES, and rural/tribal status have been presented in Figure 1 A-D.

Among those who had not taken even a single dose (unvaccinated), the most common reasons for not taking the vaccine were: due to side effects (56%); no need to take the vaccine (41.2%); do not trust the vaccines (40%); there is no such thing as COVID-19 (16%); and vaccines don't work (12%). We have described all the reasons in Figure 2. A significantly higher proportion of individuals who lived in rural villages were likely to state, 'distance to the vaccination center' (18.2% vs 0; $p = 0.045$) and costs related to the vaccines (18.2% vs 0%; $p < 0.045$) as reasons for not taking the vaccine. However, a significantly higher proportion of individuals living in the tribal villages stated 'side effects' as a reason for not taking the vaccine (64.1% vs 27.3%; $p = 0.042$). No one cited 'religious reasons' for not taking the vaccine.

In the logistic model, we found that males were significantly more likely to have completed the vaccination compared with females (odds ratio [OR]: 1.50, 95% confidence intervals [CI]: 1.03, 2.18; $p = 0.033$). Individuals in tribal villages were significantly less likely to have completed the vaccination compared with those in rural villages (OR: 0.27, 95% CI: 0.09,

Figure 1. Bar graphs showing the distribution of the reasons for acceptance of COVID-19 vaccine in 321 individuals from rural and tribal villages of Maharashtra, India, according to: A, rural/tribal status; B, age groups; C, gender; D, socio-economic status.

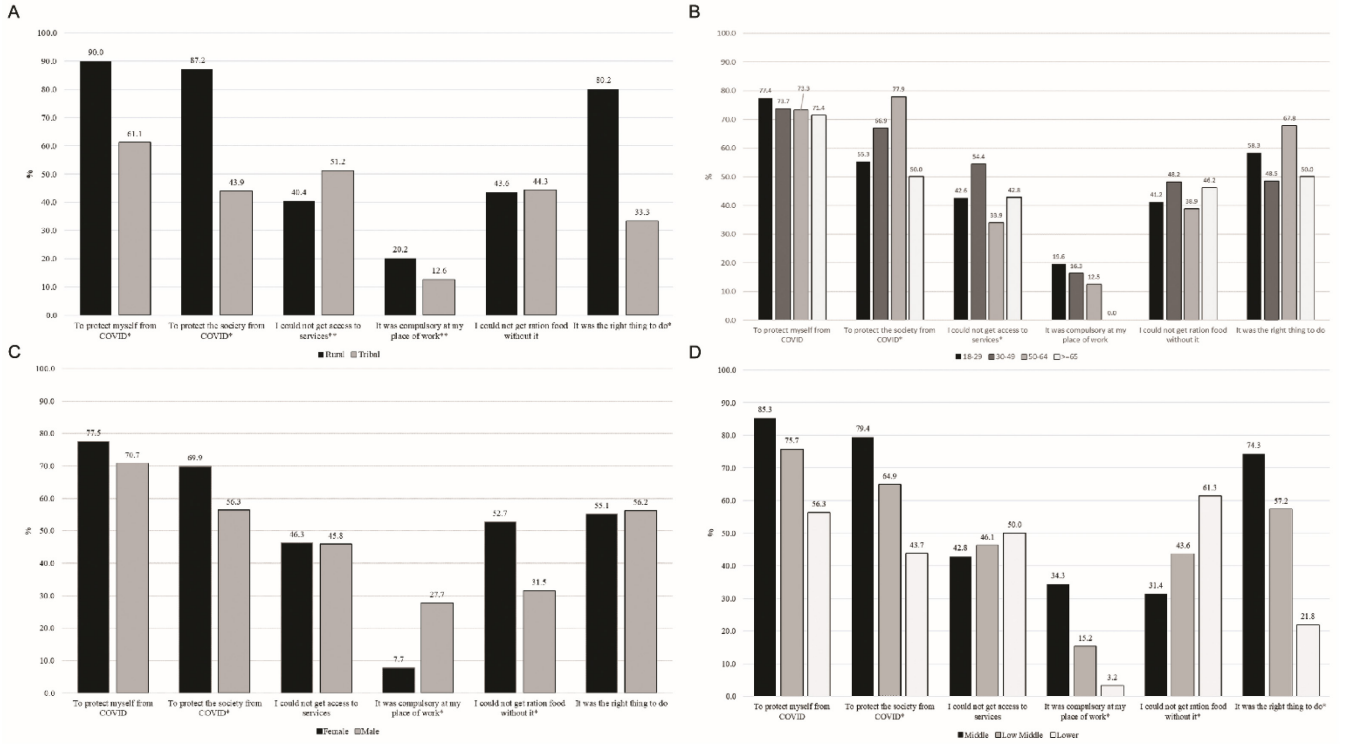
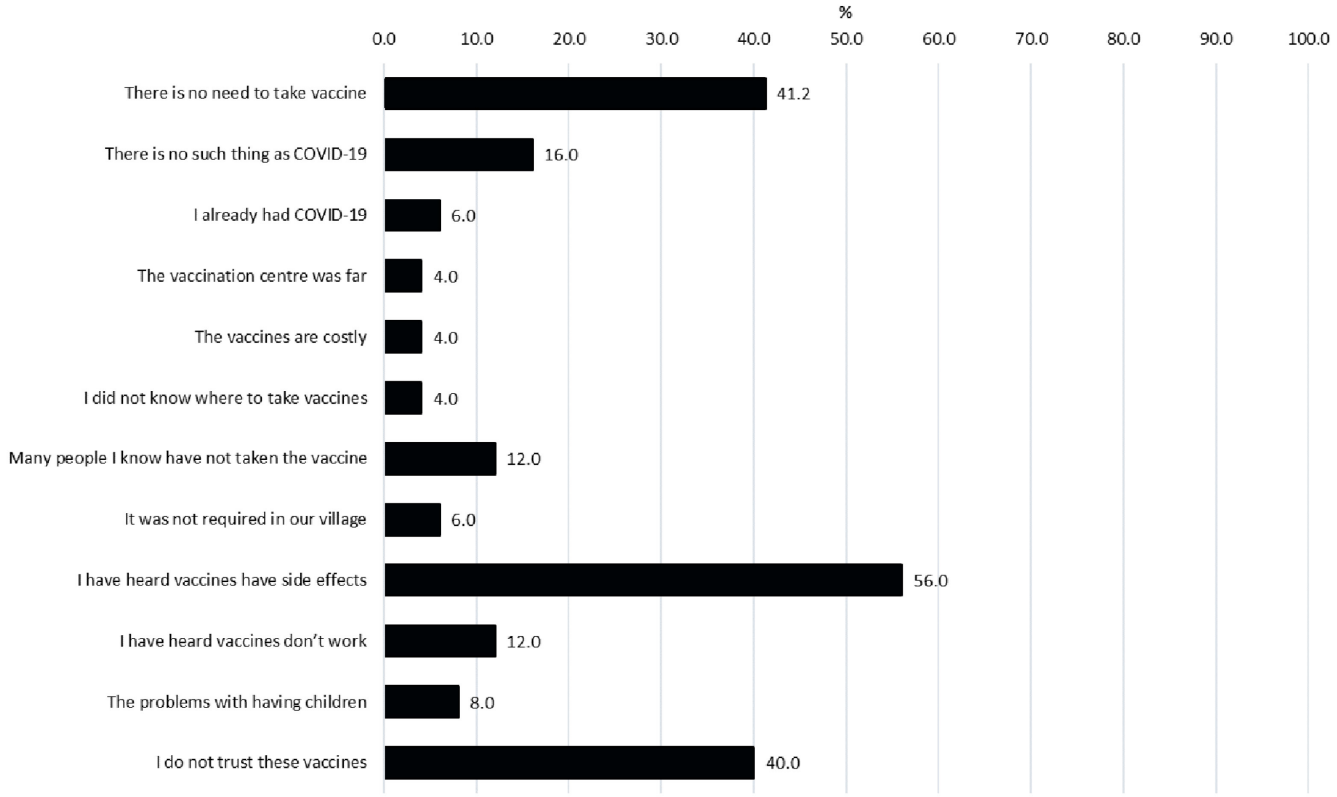


Figure 2. Bar graph showing the distribution of the reasons for not taking the COVID-19 vaccine in 52 individuals from rural and tribal villages of Maharashtra, India.



0.85; $p = 0.025$). There was no significant difference across the three SES groups. Individuals who were ≥ 65 years were less likely to have completed the vaccination (OR: 0.43, 95% CI: 0.17, 1.13; $p = 0.088$) compared with those in the age group of 18-29 years; the difference was not statistically significant. Even though the likelihood of completing the vaccine decreased with an increase in the age group, the trend was not statistically significant ($p = 0.086$).

Discussion

We found that only 13.9% had not taken even a single dose of the COVID-19 vaccine in rural and tribal regions of Maharashtra. In general, complete vaccination was significantly higher in the rural villages compared with tribal villages. Individuals belonging to the middle SES were more likely to have completed the vaccination compared with those classified as lower middle and lower SES. The reasons for taking the vaccine differed across genders – men were more likely to have taken the vaccine because it was compulsory at work, whereas women had completed the vaccination because of access to subsidized food. The common reasons for not taking the vaccine were due to reported side effects and mistrust about the vaccines.

There is a lot of variability in acceptance of COVID-19 vaccination in India. For instance, a hospital-based study from North India found that only 40% of individuals were completely vaccinated whereas another hospital-based study from South India found that 81% had been fully vaccinated with 99% having taken at least one dose of the vaccine [20,21]. Both these studies were based in health care settings compared with our study which was a community-based study in rural and tribal villages. As seen in our data, the uptake of vaccines and reasons for completing the vaccination differed according to gender and SES. Men were more likely to have completed the vaccination compared with women. Gender differences have been found in vaccination uptake. This may be due to the decision-making process – women may require permission from family members or may not find time away from their household activities [22]. Thus, specific interventions are required to increase vaccination among women. This may be done as messages delivered by Accredited Social Health Activist (ASHA) workers when they visit villages or homes, or at rural childcare centers (*anganwadis*). Individuals from the lower SES also had low vaccine uptake. This may be due to multiple factors such as the

inability to go to the vaccination center due to loss of days of work, low digital literacy, access to digital services, or mistrust of these services [22,23]. Thus, it may be important to have flexible timings for government vaccination centers along with digital support in tribal villages to improve vaccination in these areas.

Beliefs and attitudes towards vaccines/vaccination are important factors that influence vaccine uptake in the population. It has been suggested that hesitancy towards vaccination is often associated with mistrust of the vaccine and institutions [24]. The hesitancy often results in poor uptake and refusal to vaccinate [24,25]. Danabal *et al.* found that young individuals, women, and those belonging to lower SES were more likely to mistrust the vaccines [23]. As seen in our study, the main reasons for not taking the vaccine were trust and efficacy issues, and side effects. Mistrust about vaccines is a major impediment, and with a lot of misinformation about vaccines, vaccine hesitancy was an issue not only in urban and rural communities but even among healthcare personnel [12,23,26]. Globally, hesitancy towards COVID-19 vaccines was associated with education levels, awareness, misinformation, governmental efforts, and fear about infertility [27]. The occurrence of side effects after vaccination is the other concern that results in poor vaccine uptake [28,29]. Some of the common post-vaccination effects were pain at the injection site, lethargy, and fever [30,31]. Individuals who experience side effects after the first dose may hesitate to take the second dose. Effects of the vaccine on pregnancy and newborns may result in reduced uptake of the vaccine in pregnant women [32]. Thus, all vaccination programs should be upfront about the potential side effects to address mistrust about vaccines, and key local stakeholders should be included in mass vaccination programs. Though socio-cultural and religious barriers are important barriers to vaccine uptake [33], this was not an important reason in our population.

We only included individuals from three tribal and rural villages in the Western part of Maharashtra. These villages are more homogenous compared with some other parts of the country. Thus, we may have missed some specific reasons (cultural or religious) which may be seen in heterogenous regions. Furthermore, some special groups (such as young children or pregnant women) may have different vaccine uptake [32]. Our study was a cross-sectional assessment of vaccine uptake, and we did not follow the participants. It is possible that some of these individuals who have taken the first dose may have completed their second dose; thus, we may have underestimated the proportion of complete vaccination in these individuals.

Despite these limitations, the study provides useful data on the COVID-19 vaccination status in rural and tribal populations of Maharashtra, India. We found that a majority of the study participants in these six villages had completed COVID-19 vaccination. Individuals who belonged to tribal villages, women, and those from the lower SES were less likely to have taken the vaccine. Government vaccination centers were the main source of vaccination for individuals in rural and tribal areas. Men were more likely to have completed the vaccination due to requirements at the place of work, whereas women did it to avail of subsidized food (wheat/rice/pulses). Fear about side effects and mistrust about the vaccines were the main reasons for not having taken the vaccine. Thus, the inclusion of these issues in mass information campaigns and specific intervention programs may help improve the COVID-19 vaccination coverage in regions where the uptake is not adequate.

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Authors' Contribution

MSS conceived the project and was involved in data analysis and manuscript preparation; AT was involved in data collection and data handling; NR helped with administration of the project and data handling; NR helped with data analysis and manuscript preparation; PW supervised the project and helped with management, interpretation, and discussion of the findings; VK supervised the project and helped with methods and data interpretation; BS helped with project conceptualization, interpretation of findings, and editing of the manuscript.

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