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Original Research Article

CO-RELATES OF COVID 19 VACCINE HESITANCY/ ACCEPTANCE AMONG ADULT POPULATION: A COMMUNITY BASED STUDY

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ABSTRACT

Background: The use of vaccines represents a paramount public health intervention and the most efficacious approach to safeguard the population from COVID-19 particularly with the ongoing emergence of new variants. The present study aimed to assess knowledge, attitude, and practices towards the COVID-19 vaccination and to determine correlates of acceptance or refusal of COVID-19 vaccine among adults.

Materials and Methods: A community-based cross-sectional study was carried out in field practice area of urban and rural health training centre of a private medical college in Pune, India. The sample size was calculated as 800. One adult member (preferably the head of the household) and residing in the study area for more than 6 months was included in the study. Predesigned, validated, and pretested questionnaire was used for data collection. House-to-house data collection was done using interview technique by investigators with the help of field supervisors and Accredited Social Health Activists (ASHAs) or Anganwadi workers (AWWs) who are grassroot level community health workers. Relative Importance Index (RII) was calculated to determine significant reasons for vaccine acceptance/hesitancy.

Results: Total of 844 participants from urban (441,52.25%) and rural (403, 47.75%) field practice areas participated in the study. COVID-19 vaccine hesitancy was significantly higher among those with inadequate knowledge (aOR=1.48), and unfavorable attitude (aOR=3.59) towards COVID-19 vaccine. Vaccine hesitancy was seen among those aged more than 45 years of age, urban residents and employed.

Conclusion: Strengthening awareness and addressing concerns at the community level may help to improve vaccine acceptance which will be critical for improving uptake in future pandemics.

Keywords: COVID-19 vaccine, hesitancy, acceptance, co-relates.

INTRODUCTION

The coronavirus disease-2019 (COVID-19) pandemic has continued to be a significant global public health issue since it first appeared in late 2019. Since mid-February 2025, data from sentinel sites indicate a rise in test positivity rate hitting 11%. This increase is mainly observed in countries across Eastern Mediterranean, Western Pacific regions and South-East Asia region. The prevalence of LP.8.1 has been decreasing, while the reporting of NB.1.8.1, which is classified as a Variant Under Monitoring (VUM), has been on the rise, accounting for 10.7% of global sequences reported as on mid-May.[1] The use of vaccines represents a paramount public health

intervention and the most efficacious approach to safeguard the population from COVID-19, particularly with the ongoing emergence of new variants.[2] Global survey on potential COVID-19 vaccine acceptance reported that 48% of their study participants were hesitant about receiving COVID-19 vaccinations and remained unsure about whether they would get vaccinated.[3] Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite of availability of vaccination services. Perceptions of COVID-19 and its vaccine are crucial affecting willingness of vaccine uptake. It has been suggested that herd immunity can be achieved when about 70% of the population has immunity either from previous infection or vaccine.[4] A five C model of vaccine hesitancy explains that it is driven by five main determinants namely: confidence, complacency, convenience, risk calculation and collective responsibility.[5]

India has reported a total of 30,070 COVID-19 cases since the beginning of the year 2025.[6] WHO's Strategic Advisory Group of Experts on Immunization (SAGE) has emphasized the importance of vaccinating those who are at-risk of severe disease, mostly elderly and those with underlying conditions.[7] To overcome hesitancy towards the vaccine, it is essential to comprehend peoples' perceptions regarding the vaccine. Identifying co-relates of vaccine hesitancy/acceptance can help to plan interventions to increase vaccine uptake across populations belonging to urban and rural areas. Identifying the factors that interplay and result in vaccine hesitancy will also help public health policymakers to design more definitive, effective strategies having future implications for COVID-19 vaccination programme modification. Hence the present study was planned to assess awareness and attitudes towards the COVID-19 vaccination and to determine correlates of acceptance or refusal of COVID-19 vaccine among adult population in urban and rural areas.

MATERIALS AND METHODS

A community-based cross-sectional study was carried out in urban and rural field practice areas of a private medical college in Pune,India in 2021. The rural and urban field practice areas comprise of revenue villages and notified slums, respectively which were considered to as clusters. There are total of 21 clusters. From these regions, total of 8 (four clusters in each area) were selected randomly using random numbers generated by Micro soft Excel. Considering p as 21% vaccine hesitancy8, 95% confidence level, 20% relative precision, and design effect of 2, the sample size was calculated as 800. Therefore 100 households from each cluster were selected. One adult member (preferably the head of the household), who is willing to participate and residing in the study area for more than 6 months was included in the study. If the head of household is not available at the time of data collection, another adult member present was interviewed. Households that remained locked during two consecutive visits were excluded. Data was collected via a predesigned, validated, and pretested questionnaire. Initially the questionnaire was first prepared in English. Then it was translated into Marathi, then back-translated into English. It included socio- demographic background, knowledge about COVID-19 vaccination, attitudes towards COVID-19 vaccination and reasons for vaccine acceptance or hesitancy.

The purpose of the study was clearly explained to all participants and informed consent for participation was obtained. Study participants were ensured about confidentiality and privacy of responses received. House-to-house data collection was done by field supervisors with the help of Anganwadi workers (AWWs)/ Accredited Social Health Activists (ASHAs). AWWs and ASHAs are grassroot level community health workers.

Permission from Institutional Ethics Committee was obtained. (Ref: BVDUMC/IEC/33B)

Data collection tool: Data was collected using a questionnaire which included sociodemographic details (Part A), history of COVID infection in the family, history of COVID infection in the family, and history of COVID deaths in the family. Part B consisted of knowledge about COVID vaccination different types of vaccines available, the number of doses and likely side effects of COVID vaccines. Part C consisted of questions related to attitude towards the COVID vaccine (whether willing to take the COVID vaccine, whether it is important to continue the use of mask/physical distancing even after vaccination)

Data quality control: All data collectors (ASHAs, AWWs), field supervisors and site investigators (rural and urban) underwent training on data collection techniques as well as on the google survey tool. For quality control, 10% of data was collected by field supervisors for quality checks. Designated Site investigators were responsible for supervising and monitoring the activities carried out by field supervisors. The principal investigator, site investigators and field supervisors regularly reviewed the collected data for accuracy, quality, and completeness, and necessary corrections were made when required.

The Google Survey tool was used to collect data by field supervisor. If access to the online platform was not available, then data was entered in proforma. The data collected by the field supervisor was cross-checked by site investigators to ensure completeness and accuracy.

The data was analyzed using SPSS (Statistical package for social sciences) software version 28 (IBM, Chicago). The study results were presented in tabular format. For qualitative type of data various rates, ratios, and percentages (%) were computed. The mean, SD etc. were computed for quantitative data. For qualitative data, tests like the chi-square test were used for the comparison of variables. P value of

0.05 was considered as significant. Total 5 questions were related to knowledge. Those with score 3 and above were considered as adequate knowledge and inadequate knowledge if score is less than 3. Total 12 questions were related to attitude. Those with score less than 8 were considered unfavourable attitude and those with 8 or more as favourable attitude. Multivariate logistic regression analyses were applied for the adjusted odds ratio of the outcome variable with different risk factors. Relative Importance Index (RII) was calculated to determine significant reasons for vaccine acceptance/hesitancy. [9] All items were listed to measure reasons among hesitant as well as those with vaccine accepted study participants with dichotomous responses of 'yes' or 'no.' A score of 2 was given for 'yes' responses and 1 for 'no' responses. RII was calculated for each item using the formula below:

RII = ΣW/A*N

where W = weighting for each item

A = 2 (the highest weight)

N = Total number of respondents.

RESULTS

Total of 844 participants from urban (441, 52.25%) and rural (403, 47.75%) field practice areas participated in the study. The minimum age of the study participant was 18 years and the maximum was 85 years. The mean age was 41.50 years (±13.49 SD).

Knowledge about COVID-19 vaccines

Sociodemographic details of study participants and their association with knowledge about the COVID-19 vaccine are shown in [Table 1]. The majority of them were below the age of 45 years (66.94%) and females (62.68%). 10.07% of participants gave a history of COVID infection in the family. Knowledge score was significantly higher among those living in rural areas, the female gender and unemployed.

Table 1: Sociodemographic details of study participants and their association with knowledge about COVID-19 vaccine

Socio-demographic variables	Study participants' knowledge about COVID-19 vaccine			p-value*
	Inadequate knowledge (N = 186)	Adequate knowledge (N = 658)	Total (N = 844)	
Area, n (%)				
Urban	121 (65.05)	320 (48.63)	441 (52.25)	<0.001
Rural	65 (34.95)	338 (51.37)	403 (47.75)	
Age (years), n (%)				
≤45	121 (65.05)	444 (67.48)	565 (66.94)	0.535
>45	65 (34.95)	214 (32.52)	279 (33.06)	
Gender, n (%)				
Male	82 (44.09)	233 (35.41)	315 (37.32)	0.031
Female	104 (55.91)	425 (64.59)	529 (62.68)	
Marital status, n (%)				
Married	148 (79.57)	545 (82.83)	693 (82.11)	0.306
Other	38 (20.43)	113 (17.17)	151 (17.89)	
Education, n (%)				
≤10th Grade	159 (85.48)	488 (74.16)	647 (76.66)	0.001
>10th Grade	27 (14.52)	170 (25.84)	197 (23.34)	
Occupation, n (%)				
Unemployed	93 (50.00)	412 (62.61)	505 (59.83)	0.002
Employed	93 (50.00)	246 (37.39)	339 (40.17)	
Monthly income (INR), n (%)				
≤15,000	151 (81.18)	500 (75.99)	651 (77.13)	0.136
>15,000	35 (18.82)	158 (24.01)	193 (22.87)	
History of COVID-19 infection in family, n (%)				
No	172 (92.47)	587 (89.21)	759 (89.93)	0.192
Yes	14 (7.53)	71 (10.79)	85 (10.07)	
COVID-19 death in family, n (%)				
No	185 (99.46)	647 (98.33)	832 (98.58)	0.249
Yes	1 (0.54)	11 (1.67)	12 (1.42)	

Note: Those with knowledge score of 3 and above (out of 5) were considered as adequate knowledge; inadequate knowledge if score was less than 3.

*Significantly different when p<0.001

COVID-19: Coronavirus disease 2019; INR: Indian Rupee

Attitude towards COVID-19 vaccination

The association between sociodemographic variables and attitude towards COVID vaccination is depicted in table 2. The majority of the study participants favorable attitude (n=824, 97.63%) towards the vaccine. Positive attitudes towards the vaccine did not differ significantly across rural and urban areas, between men and women, or among different age groups. (p-value <0.01).

Among the study participants those with favorable attitude towards COVID-19 vaccine, 648 (78.64%) study participants had adequate knowledge about vaccines. Among those with unfavorable attitude, 50% had adequate knowledge. The level of adequate knowledge differed significantly between those with favourable attitudes and those with unfavourable attitudes. (p-value <0.001).

Table 2: Sociodemographic details of study participants and their association with attitude towards COVID-19 vaccine

Socio-demographic variable	Study participants' attitude towards COVID-19 vaccine			p-value
	Favorable attitude (N = 824	Unfavorable attitude (N = 20)	Total (N = 844)	
Area, n (%)				
Urban	432 (52.43)	9 (45.00)	441 (52.25)	0.511
Rural	392 (47.57)	11 (55.00)	403 (47.75)	
Age (years), n (%)				
≤45	555 (67.35)	10 (50.00)	565 (66.94)	0.103
>45	269 (32.65)	10 (50.00)	279 (33.06)	
Gender, n (%)				
Male	309 (37.50)	6 (30.00)	315 (37.32)	0.493
Female	515 (62.50)	14 (70.00)	529 (62.68)	
Marital status, n (%)				
Married	684 (83.01)	9 (45.00)	693 (82.11)	<0.001
Other	140 (16.99)	11 (55.00)	151 (17.89)	
Education, n (%)				
≤10th grade	630 (76.46)	17 (85.00)	647 (76.66)	0.592*
>10th grade	194 (23.54)	3 (15.00)	197 (23.34)	
Occupation, n (%)				
Unemployed	489 (59.34)	16 (80.00)	505 (59.83)	0.063
Employed	335 (40.66)	4 (20.00)	339 (40.17)	
Monthly income (INR), n (%)				
≤15,000	635 (77.06)	16 (80.00)	651 (77.13)	0.999*
>15,000	189 (22.94)	4 (20.00)	193 (22.87)	
History of COVID-19 infection in family, n (%)				
No	743 (90.17)	16 (80.00)	759 (89.93)	0.133*
Yes	81 (9.83)	4 (20.00)	85 (10.07)	
COVID-19 death in family, n (%)				
No	812 (98.54)	20 (100.00)	832 (98.58)	0.999*
Yes	12 (1.46)	0 (0.00)	12 (1.42)	
Knowledge about COVID-19 vaccine				
Inadequate knowledge	176 (21.36)	10 (50.00)	186 (22.04)	0.005*
Adequate knowledge	648 (78.64)	50.00)	658 (77.96)	

Note: Those with attitude score less than 8 (out of 12) were considered unfavorable attitude and those with 8 or more as favorable attitude.
*Fisher's exact test, otherwise it was Chi-square test
COVID-19: Coronavirus disease 2019; INR: Indian Rupee.

Details of vaccine hesitancy/acceptance and their co-relates are given in table 3. A total of 126 (14.93%) study participants did not receive the COVID-19 vaccine. Vaccine hesitancy was found to be more among aged below 45 years old, urban residents and those with other occupations (housewives, students, unemployed and retired etc). In univariate analysis, it was found that vaccine hesitancy was significantly more among age 45 years and below (Odds ratio =1.54, CI=1.01-2.36, p=0.049), those living in urban area (Odds ratio=2.61, CI= 1.73-3.95, p<0.001), employed (Odds ratio=1.49, CI=1.02-2.17, p=0.04), inadequate knowledge (Odds ratio= 1.82 (1.20-2.76), p<0.001) and negative attitude (Odds ratio =3.19 (1.25-8.16, p=0.02).

Table 3: Vaccine hesitancy/acceptance and their co-relates

Variable	Participants who received COVID vaccine			p-value	OR (95% CI)	p-value
	No (N = 126)	Yes (N = 718)	Total (N = 844)			
Age (years), n (%)						
≤45	94 (74.60)	471 (65.60)	565 (66.94)	0.048	1.54 (1.01-2.36)	0.049
>45	32 (25.40)	247 (34.40)	279 (33.06)		1	
Area, n (%)						
Urban	90 (71.43)	351 (48.89)	441 (52.25)	<0.001	2.61 (1.73-3.95)	<0.001
Rural	36 (28.57)	367 (51.11)	403 (47.75)		1	
Gender, n (%)						
Male	54 (42.86)	261 (36.35)	315 (37.32)	0.164	1.31 (0.89-1.93)	0.165
Female	72 (57.14)	457 (63.65)	529 (62.68)		1	
Marital status, n (%)						
Married	101 (80.16)	592 (82.45)	693 (82.11)	0.536	0.85 (0.53-1.39)	0.536
Other	25 (19.84)	126 (17.55)	151 (17.89)		1	
Education, n (%)						
≤10th Grade	95 (75.40)	552 (76.88)	647 (76.66)	0.717	0.92 (0.59-1.43)	0.717
>10th Grade	31 (24.60)	166 (23.12)	197 (23.34)		1	
Occupation, n (%)						
Employed	61 (48.41)	278 (38.72)	339 (40.17)	0.041	1.49 (1.02-2.17)	0.041
Other	65 (51.59)	440 (61.28)	505 (59.83)		1	

Monthly income (INR), n (%)						
≤15000	105 (83.33)	546 (76.04)	651 (77.13)	0.072	1.58 (0.96-2.59)	0.074
>15000	21 (16.67)	172 (23.96)	193 (22.87)		1	
History of COVID-19 infection in family, n (%)						
No	114 (90.48)	645 (89.83)	759 (89.83)	0.825	1.07 (0.57-2.04)	0.824
Yes	12 (9.52)	73 (10.17)	85 (10.07)		1	
Death due to COVID-19 in family, n (%)						
No	125 (99.21)	707 (98.47)	832 (98.58)	0.518	1.95 (0.25-15.19)	0.526
Yes	1 (0.79)	11 (1.53)	12 (1.42)		1	
Knowledge about COVID-19 vaccine, n (%)						
Inadequate knowledge	40 (31.75)	146 (20.33)	186 (22.04)	0.004	1.82 (1.20-2.76)	<0.001
Adequate knowledge	86 (68.25)	572 (79.67)	658 (77.96)		1	
Attitude towards COVID-19 vaccine, n (%)						
Unfavourable attitude	7 (5.56)	13 (1.81)	20 (2.37)	0.011	3.19 (1.25-8.16)	0.020
Favourable attitude	119 (94.44)	705 (98.19)	824		1	

Note: For the knowledge, those with score of 3 and above (out of 5) were considered as adequate knowledge; inadequate knowledge if score was less than 3. For the attitude, those with attitude score less than 8 (out of 12) were considered unfavorable attitude and those with 8 or more as favorable attitude.
CI: confidence interval; COVID-19: Coronavirus disease 2019; INR: Indian Rupee; OR: odds ratio

Multivariate analyses (table 4) found that the adjusted odds of vaccine hesitancy were greater among those aged more than 45 years (aOR=1.61), more in urban (aOR=2.45) as compared to rural areas and employed (aOR=1.18). COVID-19 vaccine hesitancy was also found to be significantly higher with inadequate knowledge (aOR=1.48), and attitude (aOR=3.59) towards COVID-19 vaccine.

Table 4: Multivariate analysis of co-relates of COVID-19 vaccine hesitancy

Variable	Received COVID-19 vaccine			aOR (95% CI)	p-value
	No (n = 126)	Yes (n = 718)	Total (n = 844)		
Age (years)					
≤45	94	471	565	1.61 (1.04-2.49)	0.03
>45	32	247	279	1	
Area					
Urban	90	351	441	2.45 (1.59-3.77)	<0.001
Rural	36	367	403	1	
Occupation					
Employed	61	278	339	1.18 (0.78-1.76)	0.43
Unemployed	65	440	505	1	
Knowledge about COVID-19 vaccine					
Inadequate knowledge	40	146	186	1.48 (0.96-2.29)	0.08
Adequate knowledge	86	572	658	1	
Attitude towards COVID-19 vaccine					
Unfavorable attitude	7	13	20	3.59 (1.31-9.80)	0.01
Favorable attitude	119	705	824	1	

Note: For the knowledge, those with score of 3 and above (out of 5) were considered as adequate knowledge; inadequate knowledge if score was less than 3. For the attitude, those with attitude score less than 8 (out of 12) were considered unfavorable attitude and those with 8 or more as favorable attitude.
aOR: adjusted odds ratio; CI: confidence interval; COVID-19: Coronavirus disease 2019.

The RII for reasons regarding the COVID-19 vaccine refusal or acceptance is shown in table 5 and table 6. Fear of Shots (RII=0.66), health issues (RII=0.58), concerns about side effects (RII=0.57), not sure about effectiveness (RII=0.53), not able to book a slot (RII=0.52), not sure about safety (RII=0.52), non-availability of vaccine (RII=0.51) were the reasons for not taking the vaccine. The most common reason was to prevent COVID infection (RII = 0.81), followed by social responsibility (RII=0.76), vaccine safety (RII=0.74) followed by vaccine effectiveness (RII=0.63) and presence of chronic health conditions (RII=0.53).

Table 5: Reasons for not taking vaccine (N = 126)

Reasons for not taking vaccine	Frequency (n)	RII
Fear of shots	41	0.66
Health issue	21	0.58
Concerns about side effects	17	0.57
Don't know about effectiveness	7	0.53
Not able to book slot	5	0.52
Not sure about safety	5	0.52
Vaccine is not available	2	0.51
Others	4	0.52

RII refers to Relative Importance Index (RII) which determines the significant reasons for vaccine hesitancy.

Table 6: Reasons for taking vaccine (N = 718)

Reasons for taking vaccine	Frequency (n)	RII
To prevent COVID-19 infection	445	0.81
Social responsibility	375	0.76
Vaccine is safe	351	0.74
Vaccine is effective	182	0.63
High-risk (chronic health condition)	48	0.53

RII refers to Relative Importance Index (RII) which determines the significant reasons for vaccine uptake COVID-19: Coronavirus disease 2019

DISCUSSION

This study aimed to assess awareness and attitudes towards the COVID-19 vaccination and to determine correlates of acceptance or refusal of COVID-19 vaccine among adult population in urban and rural areas. Total of 844 adults participated in the study. In our study young people (<45 years) were more vaccine hesitant as compared to those >45 years of age. This may be due to less severe disease in the younger age group. These findings are consistent with study findings conducted by Price et al.[10] The females were more vaccine hesitant. Younger people need to be motivated to get COVID-19 vaccine to achieve herd immunity. Vaccine uptake was more among rural population as compared to urban. The reasons could be more perceived risk of infection, more elderly population in rural areas and effective awareness strategies by rural healthcare workers. A previous study conducted by Wu J et al,[11] and Yoda et al,[12] have similar findings, where people from rural areas were also more willing for COVID vaccination than those in urban areas. There was a statistically significant difference in adequate knowledge among favorable and unfavorable attitudes. These findings were similar with study conducted by Venkataraman et al.[13] A total of 14.93% did not receive COVID vaccine. About 19.5% of the respondents denied vaccines in a study conducted by Danabal et al.[14] The reasons for not taking COVID-19 vaccine were fear of shots, followed by health issues, side effects and lack of effectiveness of the vaccine which were similar to study conducted by Syed et al.[9] Even the study participants with adequate knowledge and positive attitude did not receive vaccine. This may be due to poor perceived risk of COVID infection or not sure about effectiveness of vaccine. Considering rising cases of COVID variants in India, it is essential to address vaccine hesitancy through rigorous positive information through health workers and media. Understanding co-relates of vaccine hesitancy or acceptance will help to design behavior change communication strategies.

CONCLUSION

COVID-19 vaccine hesitancy was closely linked to inadequate knowledge and unfavorable attitudes, particularly among older adults, urban residents, and the employed. Strengthening awareness and addressing concerns at the community level may help to improve vaccine acceptance which will be critical for improving uptake in future pandemics.

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REFERENCES

1. COVID-19 - Global Situation [Internet]. [cited 2025 Aug 18]. Available from: https://www.who.int/emergencies/disease-outbreak-news/item/2025-DON572
2. COVAX Facility [Internet]. 2025 [cited 2025 Aug 18]. Available from: https://www.gavi.org/covax-facility
3. Lazarus JV, Ratzan S, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. Hesitant or not? A global survey of potential acceptance of a COVID-19 vaccine [Internet]. Public and Global Health; 2020 [cited 2025 Aug 18]. Available from: http://medrxiv.org/lookup/doi/10.1101/2020.08.23.20180307
4. Kwok KO, Lai F, Wei WI, Wong SYS, Tang JWT. Herd immunity – estimating the level required to halt the COVID-19 epidemics in affected countries. J Infect. 2020 June;80(6):e32–3.
5. Dubé E, Gagnon D, MacDonald N, Bocquier A, Peretti-Watel P, Verger P. Underlying factors impacting vaccine hesitancy in high income countries: a review of qualitative studies. Expert Rev Vaccines. 2018 Nov 2;17(11):989–1004.
6. Covid19 Dashboard | Home [Internet]. [cited 2025 Aug 18]. Available from: https://covid19dashboard.mohfw.gov.in/

7. SAGE updates COVID-19 vaccination guidance - PAHO/WHO | Pan American Health Organization [Internet]. 2023 [cited 2025 Aug 18]. Available from: https://www.paho.org/en/news/28-3-2023-sage-updates-covid-19-vaccination-guidance
8. Knowledge, attitude and practice towards COVID-19 vaccination acceptance in West India | International Journal Of Community Medicine And Public Health [Internet]. [cited 2025 Aug 18]. Available from: https://www.ijcmph.com/index.php/ijcmph/article/view/7769
9. Syed Alwi SAR, Rafidah E, Zurraini A, Juslina O, Brohi IB, Lukas S. A survey on COVID-19 vaccine acceptance and concern among Malaysians. BMC Public Health. 2021 June 12;21:1129.
10. Price D, Bonsaksen T, Ruffolo M, Leung J, Thygesen H, Schoultz M, et al. Willingness to Take the COVID-19 Vaccine as Reported Nine Months after the Pandemic Outbreak: A Cross-National Study. Soc Sci. 2021 Nov;10(11):442.
11. Wu J, Shen Z, Li Q, Tarimo CS, Wang M, Gu J, et al. How urban versus rural residency relates to COVID-19 vaccine hesitancy: A large-scale national Chinese study. Soc Sci Med 1982. 2023 Mar;320:115695.
12. Yoda T, Katsuyama H. Willingness to Receive COVID-19 Vaccination in Japan. Vaccines. 2021 Jan 14;9(1):48.
13. Venkataraman R, Yadav U, Shrestha Y, Narayanaswamy S, Basavaraju SHP. Knowledge and attitudes toward the COVID-19 vaccine among India's general rural population. Vacunas. 2023;24(2):128–34.
14. Danabal KGM, Magesh SS, Saravanan S, Gopichandran V. Attitude towards COVID 19 vaccines and vaccine hesitancy in urban and rural communities in Tamil Nadu, India – a community based survey. BMC Health Serv Res. 2021 Sept 21;21:994.