



The shots dilemma: COVID-19 related Vaccine hesitancy among general population in India- A cross sectional study

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ABSTRACT

Introduction

The world has encountered significant morbidity and mortality due to frequent pandemics, including COVID-19, in the past two decades. Vaccination is one of the promising measures to combat them. Though vaccines were made available by the government, coverage was low and the reasons for hesitancy were not understood well. Hence a study was conducted to assess COVID-19 vaccine hesitancy proportion and the reasons for the same in general population.

Materials and methods

A cross-sectional study was conducted among 646 adults by adopting a snowball sampling method between April and June 2021. After obtaining informed consent, online questionnaires comprising socio-demographic details, COVID-19 history, vaccination status, hesitancy towards vaccine and its reasons were distributed. The data were analysed and expressed in proportions and differences between proportions measured using chi-square test.

Results

Mean age of the participants was 32.5±12.85 years; Of them, 373(57.3%) were females. Totally, 113(17.5%) reported past history of COVID-19; 277(42.9%) reported death due to COVID-19 in their close circle. 359(56%) of the participants were vaccinated against COVID-19. 127(19.7%) reported vaccine hesitancy; of them, 50(14%) who were vaccinated were hesitant initially; 77(27%) of the non-vaccinated were hesitant. Fear of side-effects (73.2%), belief in natural immunity (33.1%) and impact on comorbid status (13.4%) were the top reasons for hesitancy. Around 40% of the participants reported difficulty in finding the vaccination centre and pre-registration process.

Conclusions

Proportion of COVID vaccine hesitancy is high in the general population. Most of the reasons for hesitancy can be overcome by creating awareness among them and proper planning.

Key Words: Vaccine, COVID-19, Hesitancy, Pandemic, General population.

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INTRODUCTION

Coronavirus disease (COVID-19) has been the most discussed public health problem in the last couple of years. The pandemic has ravaged the world, with devastating effects on people's health and well-being.¹ It is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) primarily attacking the respiratory system. In January 2020, an international concern of public health emergency was declared.

Both therapeutic and non-therapeutic measures were taken to reduce the numbers of COVID-19 cases and deaths. But the non-pharmaceutical interventions taken worldwide to tackle the pandemic have become stronger with time.^{2,3}

Vaccination is recognized as one of the highly successful public health measures that has contributed to the decline in both the mortality and morbidity of many infectious diseases.⁴ Implementing effective vaccination or achieving herd immunity becomes extremely essential. To attain COVID-19 herd immunity by natural means or by allowing a large number of people to become infected will lead to unprecedented strain on the healthcare resources.⁵ Therefore, mass vaccination is the only way forward to check COVID-19 transmission.

Vaccine hesitancy means delay in acceptance or refusal of vaccination in spite of vaccination services being available. Vaccine hesitancy is complex and context specific, varying across regions, time and vaccine type.⁶ It remains a major concern in the last few years, despite compelling evidence demonstrating the effectiveness of the vaccines in saving millions of people from disease and disability.⁶ This can apparently lead to an increase in morbidity, mortality and outbreaks of some vaccine-preventable diseases. Vaccine hesitancy for COVID-19 has emerged as a global problem in containing the COVID-19 pandemic.⁷ World Health Organization (WHO) has considered "vaccine hesitancy" as one of the top-ten threats to global health.⁸

Achieving optimal disease control, leave alone eradication, of a particular disease by lot of public health efforts has not seen light due to major barriers from vaccine hesitancy.⁹ Major skepticism about the immunization process is still prevalent in spite of substantial evidence

indicating that vaccines are safe.¹⁰ Due to a number of structural and historical factors, understanding of vaccine hesitancy is always complex. Crucial knowledge about various vaccine properties, including the extent of immunity and immunogenicity, is progressively building up and ranges across manufacturers and populations.¹¹⁻¹³ Immature knowledge regarding the immunology and virology of the COVID-19 disease along with the unparalleled pace of advancement of the vaccine has put down public confidence.¹⁴

Along with the COVID-19 appropriate behaviour, the vaccination is an additional super added benefactor that helps to curb the disease at the fullest. There is little evidence for the reasons for hesitancy among the general population in India and why hesitant individuals decided to get vaccinated. Thus, bearing all the shortcomings in the vaccination process, we conducted a study with the objectives of estimating the proportion of vaccine hesitancy among the general population of India and the various factors associated with the same.

Materials and methods

A cross-sectional study was conducted by the Department of Community Medicine, Employees' State Insurance Corporation Medical College & Post Graduate Institute of Medical Science and Research (ESIC MC & PGIMSR), Bengaluru over a period of six months (September 1, 2021 to March 31, 2022.) covering participants throughout the country. A questionnaire consisting of six parts: Socio-demographic information, COVID-19 related questions, questions on reasons for hesitancy, non-hesitancy and questions about difficulties in vaccination, was designed using Google forms. It was validated by two experts, one from Community medicine and the other from the General medicine department of ESIC MC & PGIMSR, Bengaluru, India. It was also pilot tested by circulating it among colleagues. Internal consistency was assessed by Cronbach's alpha which was >0.7 (0.73). The study population was Indian adults (≥ 18 years); consenting participants who could read and write English and had access to mobile phones, WhatsApp/ e-mail were included in the study. Participants who were already vaccinated with COVID-19 vaccine were also considered for the study as we wanted to

know if there was any initial hesitancy among them to take the vaccine. We excluded those who did not respond even after 2 reminders after sharing the online questionnaire

The required sample size was calculated by a similar study by Kenneth G *et al*¹⁵ in Tamil Nadu. Accordingly, at 95% confidence and 5% precision, to estimate a vaccine hesitancy of 40.7%, we needed to study 371 study subjects. Considering a non-response rate of 25%, the final sample size arrived at was 500. We adopted snowball sampling method for conducting the study. The validated questionnaire was sent to the contacts of the investigators, irrespective of their vaccination status. The consenting participants, after filling the Google form, further forwarded it their contacts. We received 646 responses by the time the study period ended. Ethical clearance was duly obtained from the Institute Ethics Committee (No.532/L/11/12/Ethics/ESICMC&PGI

MSR/Estt.Vol.IV). Throughout the study, patient confidentiality was maintained by censoring personal identifiers, and the final report was presented in aggregate numbers only. All categorical variables were presented as frequencies and proportions (percentage). The only continuous variable in the study *viz* age, was presented as mean and standard deviation. Contingency tables were prepared for the association between vaccine hesitancy and the various study variables, for both vaccinated and non-vaccinated groups. Chi-square test was applied to draw the association between categorical variables. P value <0.05 was considered to be statistically significant.

Results

Data from 646 participants who gave consent and completed the questionnaire were analysed. Two participants opted out of the study by not giving consent through the online questionnaire. The mean age of the participants was 32.53±12.85. The socio-demographic profile of the study participants is presented in Table 1.

Table 1 Socio-demographic details of study participants

Characteristic	Frequency	Percentage
Age in years		
18-20	118	18.3
21-30	230	35.6
31-40	137	21.2
41-50	98	15.2
51-60	41	6.3
>60	22	3.4
Gender		
Male	276	42.7
Female	370	57.3
Education status		
Up to 10th std	41	6.3
PUC/Diploma	64	9.9
Graduate	541	83.7
Occupational status		
Administrative	68	10.5
Engineer/scientist	81	12.5
Doctor/Nurse	104	16.1
Teacher	39	6.0
Business	88	13.6
Not working	266	41.2
Marital Status		
Married	294	45.5
Unmarried	338	52.3
Separated/Widowed	14	2.2
Religion		
Hindu	573	88.7
Muslim	32	5.0
Christian	27	4.2
Others	14	2.2

367 (56.8%) of the participants were between the age group of 20-40 years and 370 (57.3%) were females.

COVID-19 related information is presented in Table 2.

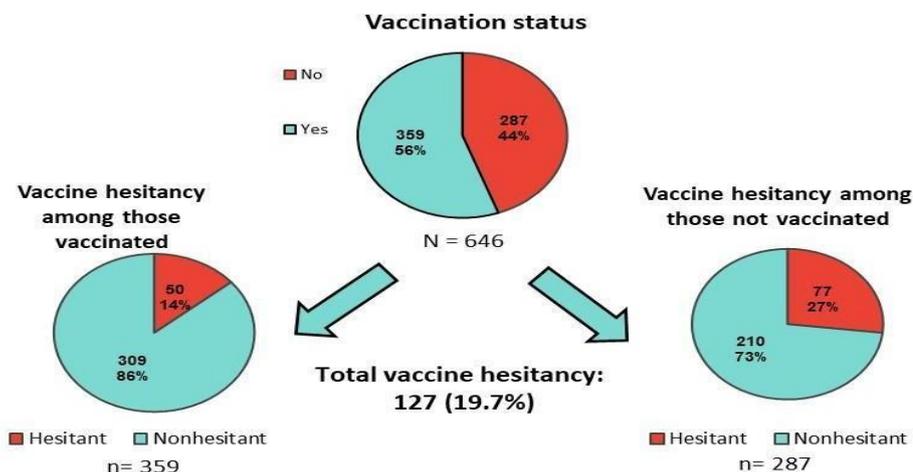
Table 2 COVID-19 related information among study population

Characteristics	Frequency	Percentage
Comorbidities present (N=646)	97	15.0
Diagnosed with COVID 19 (N = 646)	113	17.5
Place of treatment for COVID-19(N=113)		
Government hospital	13	11.5
Private Hospital	11	9.7
Isolation at home	90	79.6
Anybody diagnosed with COVID-19 (n=646)		
Family	255	39.5
Friends	223	34.5
Colleagues	106	16.4
Others	64	9.9
No one	192	29.7
Any deaths due to COVID-19 (n=646)		
No death	369	57.1
Family	114	17.6
Friends	80	12.4
Colleagues	118	18.3

Totally, 113(17.5%) of study participants were diagnosed of COVID-19 at the time of the study and 90(79.6%) of those sought isolation at home as treatment. Among the study participants, 454 (70.3%) had at least one contact diagnosed of

COVID-19 and 277(42.8%) reported death of near and dear ones due to COVID-19. Figure 1 shows vaccine hesitancy among vaccinated and non-vaccinated among the study population.

Figure 1 Vaccine hesitancy among vaccinated and non-vaccinated among study population



Among the 359 (56%) who had taken at least one dose of COVID-19 vaccine, 50(14%) participants reported that they were initially hesitant to take vaccination. When asked for the reason for changing their mind and getting vaccinated, 30(60%) said they felt it was for the sake of protection of family members, 24(48%) got

motivated by others to get vaccinated and 18(36%) because they saw less side effects among vaccine takers. Of the 287 (44%) non-vaccinated study participants, 77(27%) reported hesitancy to take the vaccine. The various reasons for COVID-19 vaccine hesitancy and non-hesitancy are presented in Tables 3 and 4 respectively.

Table 3 Reasons for vaccine hesitancy among the participants

Reasons for vaccine hesitancy	Vaccinated	Non-vaccinated	Total
	(N=50)	(N= 77)	(N= 127)
	Frequency (%)		
Afraid of the side effects from vaccines rather than its uses	40 (80)	53 (68.8)	93 (73.2)
Natural immunity is always better than vaccination	15 (30)	27 (35.1)	42(33.1)
Scared of how the vaccines might affect the co morbid state	0 (0)	17 (22.1)	17 (13.4)
Post vaccination chances of getting COVID-19 is high	5 (10)	8 (10.4)	13 (10.2)
Foreign manufactured vaccines are effective than Indian vaccines	4 (8)	9 (11.7)	13 (10.2)
Vaccine storage problems can lead to issues in effectiveness of vaccine	3 (6)	10 (13.0)	13 (10.2)
Debate among the two vaccines, Covisheid and Covaxin	0 (0)	11 (14.3)	11 (8.7)
COVID-19 vaccination should be made free of cost	3 (6)	7 (9.1)	10 (7.9)
Vaccines are a prerequisite among Health Care Workers only	3 (6)	2 (2.6)	5 (3.9)
I have less chances of contracting COVID-19	1 (2)	4 (5.2)	5 (3.9)
COVID-19 drugs are more effective than vaccination	0 (0)	3 (3.9)	3 (2.4)
Will not be allowed to drink alcohol or smoke for a certain period	0 (0)	2 (2.6)	2 (1.6)
Others	4 (8)	16 (20.8)	20 (15.7)

The top three reasons for COVID-19 vaccine hesitancy were found to be fear of side effects, perception of natural immunity being much more effective than acquired immunity and the fear of negative impact of existing co-morbid conditions

such as Diabetes Mellitus or Hypertension. The most common reason for non-hesitancy towards COVID-19 vaccination was the belief that vaccines are the need of the hour for reducing or eliminating COVID-19.

Table 4 Reasons for non-hesitancy among the participants

Reasons for non-hesitancy	Vaccinated (N= 309)	Non- vaccinated (N= 210)	Total (N= 519)
	Frequency (%)		
Vaccines are the need of the hour for reducing or eliminating COVID-19	247 (79.9)	143 (68.1)	390 (75.1)
It will protect not only me, but others also	190 (61.5)	112 (53.3)	302 (58.2)
COVID-19 vaccination helps to prevent the spread of disease	180 (58.3)	114 (54.3)	294 (56.6)
Better to be safe than sorry	180 (58.3)	109 (51.9)	289 (55.7)
My family will be protected if I get vaccinated	159 (51.5)	96 (45.7)	255 (49.1)
My doctor or health care provider recommends COVID-19 vaccine	91 (29.4)	49 (23.3)	140 (27.0)
COVID-19 vaccination will give lifelong protection	36 (11.7)	36 (17.1)	72 (13.9)
As my friends and family members insist, I want to get vaccinated	11 (3.6)	21 (10.0)	32 (6.2)
I am worried what others might think	6 (1.9)	6 (2.9)	12 (2.3)
Others	17 (5.5)	8 (3.8)	25 (4.8)

Table 5 shows the association of socio-demographic characteristics with hesitancy towards COVID-19 vaccination. Hesitancy was significantly higher among participants more than 40 years of age ($p= 0.007$), single ($p= 0.006$),

Hindus ($p= 0.015$) and those who did not have any comorbidities ($p= 0.006$) compared to their counterparts among non-vaccinated. No such difference was observed in the vaccinated group.

Table 5 Association of sociodemographic characteristics with hesitancy

Variable	Vaccinated		Statistics	Non-vaccinated		Statistics	
	Hesitant	Non-hesitant		Hesitant	Non-hesitant		
	n (%)	n (%)		n (%)	n (%)		
Age	≤ 40 y	35 (15.0)	198 (85.0)	χ ² value = 0.663, df=1, p= 0.416	61 (24.2)	191 (75.8)	χ ² value = 7.24, df=1, p= 0.007*
	> 40 y	15 (11.9)	111 (88.1)		16 (45.7)	19 (54.3)	
Sex	Male	21 (14.3)	126 (85.7)	χ ² value = 0.03, df=1, p= 0.88	29 (22.5)	100 (77.5)	χ ² value = 2.26, df=1, p= 0.14
	Female	29 (13.7)	183 (86.3)		48 (30.4)	110 (69.6)	
Education	≤ 10th	2 (14.3)	12 (85.7)	χ ² value = 0.002, df=1, p= 1	11 (40.7)	16 (59.3)	χ ² value = 2.94, df=1, p= 0.11
	> 10th	48 (13.9)	297 (86.1)		66 (25.4)	194 (74.6)	
Profession	Not working	15 (10.2)	132 (89.8)	χ ² value = 2.88, df=1, p= 0.12	33 (25.0)	99 (75.0)	χ ² value = 0.42, df=1, p= 0.59
	Working	35 (16.5)	177 (83.5)		44 (28.4)	111 (71.6)	
Marital status	Married	23 (13.1)	152 (86.9)	χ ² value = 0.175, df=1, p=0.68	42 (20.8)	77 (79.2)	χ ² value = 7.42, df=1, p=0.006*
	Single	27 (14.7)	157 (85.3)		35 (24.2)	133 (75.8)	
Religion	Hindus	44 (13.4)	285 (86.6)	χ ² value = 1.007, df=1, p=0.3178	59 (41.9)	185 (58.1)	χ ² value = 5.82, df=1, p=0.015*
	Others	6 (20.0)	24 (80.0)		18 (24.0)	25 (76.0)	
Comorbidities	Absent	42 (14.2)	253 (85.8)	χ ² value = 0.13, df=1, p=0.84	61 (48.5)	193 (51.5)	χ ² value = 8.91, df=1, p=0.006*
	Present	8 (12.5)	56 (87.5)		16 (13.7)	17 (86.3)	
h/o COVID-19	Yes	9 (14.5)	53 (85.5)	χ ² value = 0.02, df=1, p=0.84	7 (29.7)	44 (70.3)	χ ² value = 5.43, df=1, p=0.02*
	No	41 (13.8)	256 (86.2)		70 (20.8)	166 (79.2)	
h/o COVID-19 in known person	Yes	40 (15.4)	220 (84.6)	χ ² value = 1.67, df=1, p= 0.23	47 (24.2)	147 (75.8)	χ ² value = 2.07, df=1, p= 0.16
	No	10 (10.1)	89 (89.9)		30 (32.3)	63 (67.7)	
h/o COVID-19 death in known person	Yes	23 (15.0)	130 (85.0)	χ ² value = 0.27, df=1, p= 0.65	32 (25.8)	92 (74.2)	χ ² value = 0.12, df=1, p= 0.79
	No	27 (13.1)	179 (86.9)		45 (27.6)	118 (72.4)	

*statistically significant

Discussion

In our present population-based study on COVID-19 vaccine hesitancy, the total prevalence of hesitancy was found to be 19.7%. A total of 17.5% were diagnosed with COVID-19 and 15% had comorbidities. Our study took into consideration reasons for both hesitancy and non-hesitancy among vaccinated and non-vaccinated into consideration.

The prevalence of vaccine hesitancy in the present study covering participants across India is 19.7%; the proportion is higher than that previously reported in China (8.7%), on the contrary it is lower than these findings: 22.4% in France, 29.2% in Italy and 37.4% in Ethiopia.¹⁶⁻¹⁹

In a narrative review carried out by Farah Ennab et al that included 8 studies from India, vaccine hesitancy ranged from 6.3% (among healthcare workers) to 40.7% (all adults over 18). Amongst the top reasons were concerns about vaccine safety, fear of unknown side effects and the perception that COVID-19 itself was not real.²⁰ Vaccine hesitancy studies done among medical students reported hesitancy between 10-20% in India. The top reasons found were fear of side effects and lack of scientific data backing the vaccine and lack of trust in the government agencies.^{21,22} In line with our results is a study conducted by Rose Mundackal et al at a village near Bengaluru city, 19.8% were hesitant towards COVID-19 vaccination (9.4% hesitant, but didn't delay; 10.4% of study participants delayed) citing religious reasons and distrust over the pharmaceutical industry in addition to concerns over vaccine safety.²³ In a nationwide study conducted by Sneha Chandani et al in India, 37% of the study population was hesitant to take the COVID-19 vaccine.²⁴ A multicentric study conducted by Julio S. Solis Arce et al at 10 Low- & Middle-Income countries (LMICs) found that the average vaccine acceptance rate among the LMICS studied was 80.3%, which was higher than that in the United States (64.6%) and Russia (30.4%) which is much higher than the findings of our study.²⁵ A scoping review of 22 studies conducted by Ashish Joshi et al estimated the global average of COVID-19 vaccine hesitancy in October 2020 to be 16% which is close to the finding in our study (19.7%).²⁶

Certain vaccine hesitancy can be linked to a specific vaccine such as the possible link between hepatitis B vaccination and multiple sclerosis,

leading to anxiety in France²⁷ or the hesitancy based on the disproved theory that the MMR vaccine could cause autism.^{28,29} Vaccine hesitancy can also be triggered by anxiety about the administration of vaccines which includes fear of the needles,³⁰ or also by concern about the possible side effects (e.g., concern about the adolescent girls who are anxious about the potential reactions to HPV vaccination),³¹⁻³³ including those that are related to the new COVID-19 vaccines.³⁴ Various other concerns are related to vaccine components, such as thimerosal, which can be used as a preservative, or other adjuvants that increase the effectiveness of the vaccines.³⁵

In our study the primary reason for COVID-19 vaccine hesitancy was fear of side effects. This is similar to the findings in a study conducted by Chandani Set al.²⁴ There was a statistically significant difference in vaccine hesitancy between the age groups ≤ 40 years and > 40 years. Among the participants aged above 40 years, 45.7% were hesitant towards getting vaccinated. This could possibly be due to lack of awareness, lack of trust, uncertainty in effectiveness of the vaccine, concerns over the impact of vaccines on the co-morbid conditions, if any, that are more so seen in this age group. This is in line with the findings of a study conducted by Maharani et al³⁶ in Indonesia in 2021. However, findings of a meta-analysis conducted by Jonny Karunia Fajar et al³⁷ suggest a high risk of vaccine hesitancy in individuals > 50 years of age.

Fear of adverse effects, mistrust in proven vaccine safety, rumours about infertility and death as a result of the COVID-19 vaccine, among other causes, are leading to high vaccine hesitancy. The top five reasons provided for not getting vaccinated according to the "COVID-19 Symptom Survey" conducted in India in 2020 included "Waiting for others to get it first" (42%), "Other individuals need it more than me" (35%), "Fear of any adverse effect" (34%), "Vaccines will not work," (21%) and "Disbelief in the vaccine" (11%).³⁸

We found a statistically significant association between marital status and vaccine hesitancy ($p=0.006$); 24.2% of single individuals were hesitant to COVID-19 vaccines. This could be attributed to the factors like having no one to take care in case the vaccination affects their

health, fear of losing wages in case of single parents or those who are sole breadwinners of their family. It could also probably be due to the fact that they stay alone and foresee no risk of transmitting the infection. The finding is in line with a systematic review conducted by Yam B. Limbu *et al.*³⁹

There was also a statistically significant association between religion and vaccine hesitancy in our study. 41.9% of Hindu participants were hesitant towards COVID-19 vaccination. There are studies^{40,41} reporting higher vaccine hesitancy among Hindus than compared to other religions. One probable reason could be the rumours surrounding the inclusion of cow serum in the manufacture of COVID-19 vaccines. A Vaccine hesitancy study done among different communities in ten countries stated that being Muslim was associated with Vaccine hesitancy.⁴² There are several studies⁴³⁻⁴⁵ which support the same. There was a significantly negative association between religiosity/spirituality and covid-19 vaccination rates in a study that compared results of 195 regions around the world. However, when religiosity was compared with vaccination rates of 195 countries over the world showed that religiosity was negatively predicted with COVID-19 vaccination rates.⁴⁶ Further qualitative studies may explore the association of religion with vaccine hesitancy.

Statistically significant relationship with vaccine hesitancy was also obtained between comorbidity status and past history of COVID-19 infection. Increased hesitancy (48.5%) was paradoxically found in the participants who did not have any comorbidities compared to those who had a comorbid condition like Diabetes or Hypertension. This probably reflects the former's perception of COVID-19 as a less serious condition and therefore a reluctance or negligence to take vaccines. Similar results were found in a study conducted by Kumar *et al.*⁴⁷ in India.

The five Cs to tackle vaccine hesitancy include

convenience, communication, complacency, confidence and context (sociodemographic characteristics).⁴⁸ The utmost effort to concentrate on each of these factors can show a monumental improvement in vaccine acceptance.

Limitation

As it was an online study wherein the questionnaire was sent through WhatsApp groups, there might be a high non-response rate and information bias as well. To add to the same, only those who are gadget/ mobile phone literates could participate in the study. Another significant limitation would be sample representativeness as a major proportion were graduates. The proportion of vaccine hesitancy might therefore actually be an underestimate, as hesitancy is expected more among illiterates.⁴⁹

Conclusion

The proportion of total vaccine hesitancy found in our study was around 20%, which is a reasonably high estimate for a deadly pandemic like COVID-19. Even 14% of those who got vaccinated were initially hesitant, thus stressing the need to address the problem in the general population. Around 57% of our study population comprised of females; the proportion of vaccine hesitancy among them was higher in the unvaccinated group (30.4%), further demanding targeted awareness campaigns. Hesitancy was significantly higher among participants more than 40 years of age ($p=0.007$), single ($p=0.006$), Hindus ($p=0.015$) and those who did not have any comorbidities ($p=0.006$) compared to their counterparts among non-vaccinated. Fear of side-effects (73.2%), belief in natural immunity compared to vaccines (33.1%) and fear of impact on comorbid status (13.4%) were the top reasons for hesitancy. The solid foundation to address these reasons lies in effective behavioral change communication which can lead to a shift in the attitude towards vaccine acceptance. Also, around 40% of the participants reported difficulty in finding the vaccination centre and pre-registration process. Such logistic issues will have to be dealt with carefully and kept in mind in the future.

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