COVID-19 Vaccine Hesitancy among the Non Medical Adult Population Attending a Tertiary Care Hospital of Kolkata, India: A Cross-sectional Study

Community Section

ATANU ROY[1], OYIMANG PALOH[2], SAIKAT BHATTACHARYA[3], SOUMITRA MONDAL[4]

(CC) BY-NC-ND

ABSTRACT

Introduction: Vaccines play an important role in the fight against diseases whose cure is unavailable. In the battle against pandemics such as Coronavirus Disease-2019 (COVID-19), the vaccine is the only available course of prevention. The hesitancy has been found all over the world, while some find it against their religious values, others are concerned about safety, or have doubts about its efficacy. Some are hesitant due to fear of needles while some show brass negligence. Being the second most populated country globally and a developing nation, India had faced its fair share of struggles with her citizens vaccinated. Even a minute percentage of people accounts for millions; hence, it is of utmost importance to get to the root of the causes of delay in vaccination.

Aim: To find the causes of delay or hesitancy among the people attending COVID-19 vaccination centre of a tertiary care hospital of Kolkata, (a year after vaccines were introduced to the general population).

Materials And Methods: A cross-sectional study was performed in the COVID-19 vaccination centre of Medical College Kolkata, West Bengal, India, from 14th January to 14th April 2022. Total 74 non medical (not related to healthcare work) people who had come for 1st or 2nd dose of COVID-19 vaccination were included in the study. A prestructured, pretested, prevalidated questionnaire was used to collect data from the participants of the study. The Likert scale comprising of nine questions were used to assess hesitancy. Data were analysed using Chi-square test. Binary logistic regression was done to confirm any predictability of occupation, literacy rate, age and gender on vaccine hesitancy.

Results: The participants comprised of 45 (60.8%) females and 29 (39.2%) males, aged between 18 to 60 years with the mean age of 33.75±11.06 years. The participants included 22 (29.7%) people who had just taken their first dose. Twenty six (35.1%) participants were hesitant. The most common causes of hesitancy were individuals' fear of the vaccine and its impact on general health, unavailability of slots for vaccination and reluctance. Out of total, 58 (78.4%) people had faith in vaccines made in India and 48 (64.9%) persons believed that the vaccine would provide complete protection against COVID-19.

Conclusion: People were mainly concerned about safety issues as adequate and reliable information was not available to them. Some of them ignored the importance of vaccination while some could not get vaccinated due to the unavailability of slots.

INTRODUCTION

The novel coronavirus disease, Coronavirus Disease-2019 (COVID-19) has become the fifth documented pandemic since the 1918 flu pandemic [1]. The COVID-19 disease originated from the Huanan Seafood Wholesale Market, Wuhan, Hubei province, China and the subsequent outbreak of pneumonia cases occurred in Wuhan City from late December 2019 [1]. Since its emergence, it has spread to almost every country around the globe within a few months. World Health Organization (WHO) declared the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection a pandemic on 11 March 2020 [2]. Due to it's contagiously and longer incubation period, a worldwide lockdown was initiated. The virus was targeting the lungs and likely bound with the angiotensin-converting enzyme 2 receptor, which is highly expressed in the nasal epithelial cell [3,4] and undergoes local replication and propagation, along with the infection of ciliated cells in the conducting airways. After that, it involves upper respiratory tract resulting in symptoms like fever, dry cough. But, COVID-19 has a wide range of clinical presentations, varying from asymptomatic carrier state to viral pneumonia in addition to various extrapulmonary manifestations including cardiac, nervous, renal, gastrointestinal and coagulation systems [5-9].

Amidst all the adversity, a race for a cure or a vaccine for the disease had already begun in different countries [10-14]. This soon brought a couple of vaccines into the light that was clinically working. Although vaccination has been proved to be effective against several diseases in the past, 'taking a jab' was still voluntary. Amongst the rising tides of COVID-19 patients, the vaccination seemed to be the only protection one can have until a cure was discovered. However, vaccination was not accepted by different sections of society, while some saw it as unacceptable in terms of religious grounds, others were not sure if it was safe [10]. A wide range of rumours and unscientific remedies have surfaced which caused more harm than any good. There had been promotions by anti-vaxxers on the different social platforms, who promoted against taking the vaccination [8]. There has been a fair share of studies done regarding hesitancy in various countries [12-14] but instead of general population Indian studies involved specific groups like medical students [12]. So, present study focused on personnel who were not involved in medical profession any way.

Vaccination in India had begun on 16th January 2021. In the first phase, the vaccination programme for health workers and frontline workers; the second phase of vaccination started on 1st March and vaccines were made available for people of 60 years or above age and people having comorbidities of age 45 years and above. From 1st April all people of age 45 and above were eligible for vaccination. In the third phase, vaccines were available for all adults (18+) from 1st May [15]. The Government of India had increased the duration between the two doses of the available vaccines on the advice of the National Expert Group on Vaccine Administration for COVID-19 (NEGVAC) [16]. On a much more recent note, the vaccination

for 15-18 years old has begun on 3rd January 2022. In spite of prompt introduction of mass vaccination India with the world's second-largest population (1.38 billion in 2020) is still struggling to reach a satisfactory level of vaccination [17].

The hesitancy among the general population of one of the most diverse and largest populations of the world needs to be known, understood and resolved at the earliest to prevent another global lockdown. Given the diversity of the peoples in India, the nature and causes of delay are expected to be versatile too. Thus, this study embarks to find the causes of hesitancy to avail of vaccine in the eligible age group, a year after vaccines were introduced to the general population.

MATERIALS AND METHODS

A cross-sectional study was conducted in the COVID-19 vaccination centre of Medical College Kolkata, West Bengal, India, from 14th January, 2022 to 14th April, 2022 for a duration of 3 months. The study was approved by the Institutional Ethics Committee (MC/KOL/IEC/NON-SPON/1257/01/2022 dated 13.01.2022). Written consent was taken from each participant after thoroughly explaining the study and its utility and complete confidentiality of their responses. No personal identification details were asked or taken from them. Those who could not read were explained orally in their mother tongue and then consent was taken in presence of a witness.

Inclusion criteria: Non medical (not related to healthcare work) people aged ≥18 years and who had come for 1st or 2nd dose of COVID-19 vaccination were included in the study.

Exclusion criteria: The people receiving the booster/precautionary dose, aged <18 years and people who refused to participate in the study were excluded from the study.

Sample size: The sample size for the cross-sectional study was calculated using formula:

$$n = \frac{(Z \times Z)pq}{L \times L}$$

The prevalence of hesitancy was taken as 22.5% from previous study [14]. The precision (L) was taken to be 10%. The results so obtained were 67. We calculated the final sample size by taking a 10% non response rate to get the sample size as 74.

Data collection: Data were collected from the participants in a self-administered interview guide prepared by the investigators. Questions for hesitancy scale were framed and face and content validity was achieved with the help of experts from public health.

Questionnaire

Internal consistency of the questionnaire as determined by Chronbach's alpha was satisfactory (0.71). The questionnaire was translated in local languages (Hindi and Bengali) by linguist. Those who were illiterate and yet decided to participate in the study were asked to listen to the questions dictated by the investigators in their mother tongue as written in different sets of questionnaires of different languages. Care has been taken to explain the participants the exact meaning of the questions and reassuring that their opinion is completely confidential without influencing their answer in the slightest.

The 'Hesitancy' was determined from a set of nine questions using the Likert scale. The questions assessed individuals' opinions but more specifically look into their trust level about each parameter of the COVID-19 vaccine, the parameters considered were efficacy, community benefit, time of arrival, safety, side-effects in the long-term or short-term, hindrances to day to day activity. These parameters were chosen by studying previous articles and the most prevailing causes of hesitancy were selected [12,14,18]. The answers were scored from 1-to 5, ranging from 'Strongly Disagree' to 'Strongly Agree'. The summation of the scores of all the nine questions was

used as the final value to determine hesitancy. A minimum value of 36 was required to be obtained for the participant to be 'nonhesitant'. The minimum value was achievable only if all the 9 questions were answered to "Agree" or atleast five questions "strongly agree" and rest "undecided". All values below 36 were assumed to be hesitant in taking COVID-19 vaccines for the purpose of this study only.

Demographic variables like age, gender, religion and educational status were included for comparison purpose. Which dose (1st or 2nd) the recipient is having is also considered as an independent variable. Apart from hesitancy questionnaire one open ended question was also asked to understand the reason of delay in receiving vaccination. A person can state more than one reason for delay and similar responses were clubbed and listed finally.

STATISTICAL ANALYSIS

The data were analysed using Statistical Package for Social Sciences version 20.0. Central dispersion measures were calculated for continuous variables. Demographic data were represented in frequency and percentage. The Chi-square test and risk estimation were done to find any significant association between demographic variables and hesitancy. Alpha error was taken at 5% level to consider one association significant. Binary logistic regression was done to confirm any predictability of occupation, literacy rate, age and gender on vaccine hesitancy.

RESULTS

The study participants comprised of 45 (60.8%) women and 29 (39.2%) men, aged between 18 to 60 years with the mean age being 33.75±11.06 years. Among the study population 27 (36.48%) of people had not completed secondary education. Only 14 (18.9%) of the people were graduates and above. Out of total, 22 (29.7%) of the participants had just taken their first dose of the COVID-19 vaccine and 26 (35.1%) of the recipients who had come for the vaccination were still hesitant [Table/Fig-1].

Variables	n (%)
Gender	
Male	29 (39.2)
Female	45 (60.8)
Religion	
Hinduism	36 (48.6)
Islam	38 (51.4)
Education status	
Illiterate	6 (8.12)
Below secondary education	32 (43.24)
Higher secondary and above	36 (48.64)
Vaccine dose recipients	
1st dose	22 (29.7)
2nd dose	52 (70.3)
Hesitancy status (as per hesitancy scale)	
Hesitant (score <36)	26 (35.1)
Non-hesitant (score ≥36)	48 (64.9)

[Table/Fig-1]: Distribution of study subjects as per demographic variables and hesitancy (N=74).

As per the nine item Likert scale for hesitancy it was seen that mean score obtained was more then four (regarded as non hesitant) for five out of those nine items. It was lowest (3.66±0.96) for the agreement on the efficacy of foreign made vaccines. The study revealed that 35 (47.3%) of the participants had faith in vaccines of foreign origin while 58 (78.4%) believed vaccines made in India were more effective. [Table/Fig-2]. The overall idea of the vaccine among the participants reveals that 48 (64.9%) of them believe that it would provide complete protection against COVID-19.

Questions	Score (Mean±SD)	Strongly agree (n,%)	Agree (n,%)	Not sure (n,%)	Disagree (n,%)	Strongly disagree (n,%)
Whether the vaccine would stop complications?	4.24±0.79	34 (45.95)	24 (32.43)	16 (21.62)	0	0
Whether It would prevent catching COVID-19?	3.91±1.04	28 (37.84)	20 (27.03)	19 (25.68)	6 (8.11)	1 (1.35)
Whether vaccine is important for community health?	4.64±0.58	52 (70.27)	18 (24.32)	4 (5.41)	0	0
Whether faith is there in vaccines made in India?	4.40±0.82	46 (62.16)	12 (16.22)	16 (21.62)	0	0
Whether faith is there in vaccines made in abroad?	3.66±0.96	20 (27.03)	15 (20.27)	33 (44.59)	6 (8.11)	0
Whether the vaccine had arrived right on time?	3.82±1.03	25 (33.78)	20 (27.03)	20 (27.03)	9 (12.16)	0
Whether the vaccine would impact the day to day activities?	3.86±1.26	36 (48.65)	10 (13.51)	10 (13.51)	18 (24.32)	0
Whether vaccine is required if the person already had COVID-19?	4.40±1.03	52 (70.27)	8 (10.81)	6 (8.11)	8 (10.81)	0
Whether vaccine is still required if the cases have decreased?	4.52±0.84	54 (72.97)	7 (9.46)	11 (14.86)	2 (2.7)	0

[Table/Fig-2]: Distribution of mean scores and answers given to the likert scale (N=74).

No significant association were found between hesitancy and age (p-value=0.26), gender (p-value=0.55), educational qualification (p-value=0.34), religion (p-value=0.07) and dose taken (p-value=0.22) [Table/Fig-3].

Variables	Hesitant (score<36) (n=26)	Non hesitant (scrore≥36) (n=48)	Chi-square value	p-value
Age				
<33 (Median)	10	25	1.25	0.26
≥33 (Median)	16	23		
Gender				
Male	9	20	0.35	0.55
Female	17	28		
Religion				
Hinduism	9	27	3.15	0.07
Islam	17	21		
Educational status				
Illiterate	3	3	0.88	0.34
Secondary and below	7	25		
Higher secondary and above	16	20		
Vaccine dose taken				
First dose	10	12	1.46	0.22
Second dose	16	36		

[Table/Fig-3]: Distribution of hesitancy status of participants in relation to demographic factor (N=74).

Some of the most common causes of delay in vaccination were: the individual's fear of the vaccine in 11 (14.9%) and its impact on general health in 22 (29.7%), unavailability of slots for vaccination in 14 (18.9%) and reluctance in 13 (17.7%). Whereas, 10 (13.5%) of the participants were concerned about the long-term side-effects and 9 (12.2%) are completely unaware of any changes that the vaccine may or may not produce [Table/Fig-4].

Reason for delay	n (%)
Individual's fear of vaccine	11 (14.9%)
Fear of short-term and long-term impact	22 (29.7%)
Preferred to wait and watch	10 (13.5%)
Unaware of effect of vaccine	9 (11.6%)
Unavailability of slots for vaccination	14 (18.9%)
Reluctance/Negligence	13 (17.7%)
Sick or already infected with COVID-19	4 (5.6%)
Pregnant	1 (1.4%)
Others	9 (11.6%)

[Table/Fig-4]: Important reasons of delay in getting vaccinated (N=74)*.
Others: Shifting of residence, No Leave from workplace, Vaccination Centre far from home
*Multiple response

DISCUSSION

The questionnaire containing nine questions, was considered to study the participants' opinion regarding vaccine efficacy, community benefit, time of arrival, safety, side-effects in the long-term or short-term, hindrances to day to day activity. It is our understanding that if a subject lacks confidence in either of the above-said parameters he is hesitant about the vaccine even if he takes the jab. The participant's trust in the newly developed vaccine is stressed in this study and even a single doubt compromises their faith in the overall vaccine. India has the world's second-largest population. Hence, the vaccine requirement for India is proportionately higher than any developed nation. The vaccines for SARS-CoV-2 were developed rapidly and were available in the market faster than any other vaccine in the past. However, while these vaccines were still in different phases of trials the developing nations could not risk buying them as the worldwide lockdown had struck them hard. In the meantime, the developed nation bought the lion's share of the vaccines available in their testing phases itself. Thus 60-80% of developed nations' citizens were vaccinated while countries like India, and Africa are still struggling to acquire and vaccinate their people [18,19]. One of the major reasons for delayed vaccination found in this study was the unavailability of slots for vaccination. A massive demand, and limited resources accompanied by poor distribution cause wastage of vaccines leading to an immense crisis of vaccines at centres [18,19]. This explains one of the reasons for the delay.

Vaccine safety has been a serious concern among people of all countries. The vaccines were being acquired even before they had completed all phases of the clinical trial. The virus was new and highly contagious with very little known about its pathophysiology. The entire disease and its treatment were vague to the general masses. The mass hysteria created more doubts than preventions. Side-effects of vaccines were one major reason for delayed vaccination and hesitancy as evident from the results. The doubt about the effectiveness of the vaccines was reflected across the world and is evident in several studies [20-25]. present study showed that 12.2% of the participants are completely unaware or do not believe in the effectiveness of the vaccine and 13.5% were concerned about the long-term effects that the vaccine may produce. In the massive population of India, even small percentages account for millions of people which in turn reflects a significant number of concerned people all over the earth.

The present study participants comprise 60.8% females which was contrary to previous hesitancy studies done in India [24,25]. However, it is as par with recent studies done on dental students globally [26] and university students in Italy [25]. In the present study, no significant association with any of the demographical factors such as age, sex, religion and education level was found. This is quite rare as other studies have shown significant association with economic status, gender or literacy rate [25,27].

Vaccine safety and efficacy were the most common reasons for delay even though significant time had passed after the introduction

of COVID-19 vaccines. Among the various reasons, reluctance occupied a significant portion. The participants claimed to have no reason for the delay, they just did not want to take a vaccine. Whether this hesitancy has a deeper cause like fear of needles is unexplored, however, a significant number of people are included in reluctance. Such reluctance is quite likely to make future battles against pandemics tougher. Unless there are some deep-lying roots to this reluctance, one may assume that it is sheer irresponsibility on their side. They are not only compromising themselves but also their family and their community. A summarised comparison of findings of the present study and previous similar studies [19,22,23,25,27-29] are given in [Table/Fig-5].

CONCLUSION(S)

The results of present study revealed that 29.7% of study subjects were receiving first dose of vaccine after more than eight months of initiation of vaccination program. This is alarming and points towards their hesitancy for receiving vaccine. As per the hesitancy score also, it was found about one-third of the subjects hesitant about this vaccine. Fear of the adverse events following vaccination, unavailability of slots due to mandatory online registration was stated to be main reasons of this delay. This study was hospital based and conducted on people attending the vaccination centre. Hence, large community based studies are recommended to discover any new causes of hesitancy or any other issues like geographical barriers

Authors name of studies	Place and year of the study	Sample size	Objective of the study	Key findings
Nguyen LH et al., [19]	United States of America and United Kingdom, 2021	U.S.A- 87388 UK- 1254294	To determine vaccine hesitancy among people of different ethnicity and races.	About 50-57% were concerned about the long-term side-effects of the vaccine and 45-54% were worried about the adverse reactions of the vaccines.
Chaudhary FA et al., [22]	Pakistan, 2021	423	To study factors associated with acceptance of COVID-19 vaccine compared to hesitance in the Pakistani population.	Total 53% of the participants planned to get vaccinated. A significantly higher proportion of the better educated, higher income and healthier participants were in the vaccine acceptance group. 57% of the participant were females (majority) 50% of the participants were college educated.
Chandani S et al., [23]	India, 2021	1638	To analyse the vaccination willingness and perspectives of the general public in India.	Majority of the participants were male (55%) 81% of the participants were college educated. 70% of the population were concerned regarding vaccines 20.63% were unaware of any vaccines, 27% were not sure if they will take the vaccine and 10 10% refused to take any.
Barello S et al., [25]	Italy, 2020	735	To evaluate the attitude towards future vaccines to prevent COVID-19. To evaluate the impact of university curricula on vaccine hesitancy.	Total 86.1% of the participants were open to COVID-19 vaccination and 13.9% were hesitant. 79.6% of the respondents were female (majority). Mean age was 23.6±4.9 years.
Wagner AL et al., [27]	India, 2020	450	To describe the socio-demographic patterns of vaccine hesitancy in Chandigarh, India.	More than 97% of the mothers thought that childhood vaccines were important, effe ctive weay to protect against disease. 39% of the mother s were concerned of the side-effects. Scheduled castes or scheduled tribes had 3.48 times greater odds of vaccine hesitancy as compared to other caste groups. A high school education had 0.10 times the odds of vaccine hesitancy. Those having more antenatal care visits were less like to be vaccine hesitant.
Sharun K et al., [28]	India, 2020	351	To analyse the beliefs and barriers associated with COVID-19 vaccination among the general population in India.	Total 55% of the participants believed that COVID-19 vaccination was safe; 46.2% believed it to be actually effective. Concerns regarding vaccine side-effects acted as the key barrier to vaccine acceptance. 58.1% of the participants were male, 41.3% were female and remaining refused to comment. 53% of the participants were students -62.7% of which were having a university degree.
Graffigna G et al., [29]	Italy, 2020	1004	To understand the citizens perception and behaviours about preventive behaviours willingness to vaccine for COVID-19.	Total 59% of the respondents were likely to vaccinate. Middle aged group were less likely to vaccinate for COVID-19 as compared to 18/34 years old. Willingness to vaccinate was positively correlated with both trust in scientific research and general attitude.
Present Study	India, 2022	74	To find the causes of delay in COVID-19 vaccination post 1 year vaccination drive.	Total 35.1% of the participants were hesitant. 60.8% of the participants were females 36.48% of the participants had below secondary education. 14.9% were afraid of taking the vaccine; 18.9% could not find a slot for vaccination and 29.7% were concerned about the long-term side-effects of the vaccine.

[Table/Fig-5]: Comparison of key findings with similar studies.

Limitation(s)

Present study was a monocentric study, so comparison of the views of people from other regions could not be done. This study reflected the hesitancy of only those people who arrived at the tertiary healthcare facility in Kolkata. It is important to compare how similar or dissimilar the views of people attending tertiary care facilities in other regions (like North Bengal) to discover any new causes of hesitancy or any other issues like geographical barriers that may cause delays in vaccination. The hesitancy scale in present study works in an all or none policy. Authors were unable to grade the levels of hesitancy as it would require more elaborate questioning of the participants followed by addressing other scales of determining stress and trust levels. The people who came to the vaccination centre were mostly under a time crunch or were not the most co-operative people either.

that may cause delays in vaccination including those who were more hesitant and not even attending the vaccination centre.

REFERENCES

[1] Liu YC, Kuo RL, Shih SR. COVID-19: The first documented coronavirus pandemic in history. Biomed J. 2020;43(4):328-33.
[2] Archived: WHO Timeline-COVID-19. [cited 2022 Sep 7]. Available from: https://www.who.int/news/item/27-04-2020-who-timeline-covid-19
[3] Berekaa MM. Insights into the COVID-19 pandemic: Origin, pathogenesis, diagnosis, and therapeutic interventions. Front Biosci Elite Ed. 2021;13(1):117-39.
[4] Fehr AR, Perlman S. Coronaviruses: An Overview of Their Replication and Pathogenesis. Coronaviruses. 2015;1282:1-23.
[5] Ren LL, Wang YM, Wu ZQ, Xiang ZC, Guo L, Xu T, et al. Identification of a novel coronavirus causing severe pneumonia in human: A descriptive study. Chin Med J (Engl). 2020;133(9):1015-24.
[6] Zheng YY, Ma YT, Zhang JY, Xie X. COVID-19 and the cardiovascular system. Nat Rev Cardiol. 2020;17(5):259-60.

[7] Wu Y, Xu X, Chen Z, Duan J, Hashimoto K, Yang L, et al. Nervous system involvement after infection with COVID-19 and other coronaviruses. Brain Behav Immun. 2020;87:18-22.

[8] Covid-19 and the digestive system-Wong-2020-Journal of Gastroenterology and Hepatology-Wiley Online Library. [cited 2022 Sep 7]. Available from: https://onlinelibrary.wiley.com/doi/10.1111/jgh.15047.

[9] Middeldorp S, Coppens M, van Haaps TF, Foppen M, Vlaar AP, Müller MCA, et al. Incidence of venous thromboembolism in hospitalised patients with COVID-19. J Thromb Haemost. 2020;18(8):1995-2002.

[10] COVID-19 and the anti-vaxxers-John Ashton, 2021. [cited 2022 Sep 7]. Available from: https://journals.sagepub.com/doi/full/10.1177/0141076820986065.

[11] Miyazaki K, Uchiba T, Tanaka K, Sasahara K. Characterizing the Anti-Vaxxers' Reply Behavior on Social Media. arXiv; 2021 [cited 2022 Sep 7]. Available from: http://arxiv.org/abs/2105.10319.

[12] COVID-19 vaccine hesitancy among medical students in India. Epidemiology & Infection. Cambridge Core. [cited 2022 Sep 7]. Available from: https://www.cambridge.org/core/journals/epidemiology-and-infection/article/covid-19-vaccine-hesitancy-among-medical-students-in-india/B1AA32D7F818FDA6330FDED446634E25.

[13] Kanozia R, Arya R. "Fake news", religion, and COVID-19 vaccine hesitancy in India, Pakistan, and Bangladesh. Media Asia. 2021;48:01-09.

[14] COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates-PMC. [cited 2022 Sep 7]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7920465/.

[15] India's Journey To 1 Billion Covid Shots. See Timeline . NDTV.com. [cited 2022 Sep 7]. Available from: https://www.ndtv.com/india-news/coronavirus-indias-journey-to-1-billion-covid-19-shots-see-timeline-2582719.

[16] AdministrationofSecondDoseofCovishieldVaccinePriortoPrescribedTimeInterval.pdf [Internet]. [cited 2022 Sep 7]. Available from: https://www.mohfw.gov.in/pdf/AdministrationofSecondDoseofCovishieldVaccinePriortoPrescribedTimeInterval.pdf.

[17] Population, total-India/Data. [cited 2022 Sep 7]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=IN.

[18] Kricorian K, Civen R, Equils O. COVID-19 vaccine hesitancy: misinformation and perceptions of vaccine safety. Hum Vaccines Immunother. 2022; 18(1):1950504. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8920251/.

[19] Nguyen LH, Joshi AD, Drew DA, Merino J, Ma W, Lo CH, et al. Self-reported COVID-19 vaccine hesitancy and uptake among participants from different racial and ethnic groups in the United States and United Kingdom. Nat Commun. 2022;13(1):636.

[20] Jharkhand tops in vaccine wastage; Kerala, West Bengal report negative wastage -The Economic Times. Available from: https://economictimes.indiatimes.com/news/india/jharkhand-tops-in-vaccine-wastage-kerala-west-bengal-report-negative-wastage/articleshow/83396428.cms?from=mdr.

[21] Mutombo PN, Fallah MP, Munodawafa D, Kabel A, Houeto D, Goronga T, et al. COVID-19 vaccine hesitancy in Africa: a call to action. Lancet Glob Health. 202;10(3):e320-e21.

[22] Chaudhary FA, Ahmad B, Khalid MD, Fazal A, Javaid MM, Butt DQ, et al. Factors influencing COVID-19 vaccine hesitancy and acceptance among the Pakistani population. Hum Vaccines Immunother. 2021;17(10):3365-70.

[23] Chandani S, Jani D, Sahu PK, Kataria U, Suryawanshi S, Khubchandani J, et al. COVID-19 vaccination hesitancy in India: State of the nation and priorities for research. Brain Behav Immun - Health. 2021;18:100375.

[24] Palamenghi L, Barello S, Boccia S, Graffigna G. Mistrust in biomedical research and vaccine hesitancy: the forefront challenge in the battle against COVID-19 in Italy. Eur J Epidemiol. 2020;35(8):785-88.

[25] Barello S, Nania T, Dellafiore F, Graffigna G, Caruso R. 'Vaccine hesitancy' among university students in Italy during the COVID-19 pandemic. Eur J Epidemiol. 2020;35(8):781-83.

[26] Riad A, Abdulqader H, Morgado M, Domnori S, Koščík M, Mendes JJ, et al. Global Prevalence and Drivers of Dental Students' COVID-19 Vaccine Hesitancy. Vaccines. 2021;9(6):566.

[27] Wagner AL, Shotwell AR, Boulton ML, Carlson BF, Mathew JL. Demographics of Vaccine Hesitancy in Chandigarh, India. Front Med (Lausanne). 2021;7:585579. Available from: https://www.frontiersin.org/articles/10.3389/fmed.2020.585579.

[28] Sharun K, Faslu Rahman CK, Haritha CV, Jose B, Tiwari R, Dhama K, et al. Covid-19 vaccine acceptance: Beliefs and barriers associated with vaccination among the general population in india. J Exp Biol Agric Sci. 2020;S210-S.

[29] Graffigna G, Palamenghi L, Boccia S, Barello S. Relationship between Citizens' Health Engagement and Intention to Take the COVID-19 Vaccine in Italy: A Mediation Analysis. Vaccines. 2020;8(4):576.

PARTICULARS OF CONTRIBUTORS:
1. Undergradaute Student, Department of Community Medicine, Medical College Kolkata, West Bengal, India.
2. Undergradaute Student, Department of Community Medicine, Medical College Kolkata, West Bengal, India.
3. Associate Professor, Department of Community Medicine, Nil Ratan Sircar Medical College and Hospital Kolkata, West Bengal, India.
4. Tutor, Department of Community Medicine Department, Medical College Kolkata, West Bengal, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Soumitra Mondal,
S4/5, Srabonia bason, FC-Block, Sector-III Saltlake,
Kolkata-700106, West Bengal, India.
E-mail: commedrhub@gmail.com

AUTHOR DECLARATION:
• Financial or Other Competing Interests: None
• Was Ethics Committee Approval obtained for this study? Yes
• Was informed consent obtained from the subjects involved in the study? Yes
• For any images presented appropriate consent has been obtained from the subjects. NA