Original Article

Attitude and perception of COVID-19 vaccines in healthcare workers

Milind R. Ubale[1], Tushar R. Bagle[2], Sunita Gaikwad[3], Pooja A. Baviskar[4], Vaibhavi A. Nanoty[1]

Departments of [1]Microbiology, [2]Pharmacology, [3]Obgy and [4]Biochemistry, RGMC & CSMH, Thane RGMC & CSMH, Thane, Maharashtra, India

Abstract

Introduction: Till date, there is no particular medicine that has shown minimum impact on COVID-19 cases and mortality and prevention by vaccination remains the only option. **Objective:** This study aims to explore knowledge, attitude, and practices of healthcare workers (HCWs) toward COVID-19 vaccine. **Material and Methods:** This is a cross-sectional study done on HCWs. Both online (Google forms) and offline, the study questionnaire was distributed. The questionnaire was validated and consisted of knowledge, attitude, and perception about COVID-19 questions. **Results:** A total of 300 HCWs were included in the study. A total of 144 (48%) of the HCWs were aged between 18 and 30 years. In addition, 191 (63.34%) participants were willing to take any COVID-19 vaccine while 20 (6.67%) are not sure of taking vaccine. A total of 208 (69.34%) felt that COVID-19 vaccine will limit the spread of infection to family members. Furthermore, 225 (75%) felt that family physicians' decision is important to take a decision on vaccination, whereas 199 (66.33%) avail COVID-19 information from government sources. Moreover, 264 (88%) felt that success will depend on general peoples' acceptance of COVID-19 vaccination. Furthermore, 77 (25.67%) said that they will not be taking COVID-19 vaccine because of side effects, 229 (76.33%) felt that vaccine safety is important, and 144 (48%) are not sure if vaccination will end the COVID 19 pandemic. **Discussion:** Challenges to motivate HCWs, family physician, and general population needs to be undertaken by focusing on factors like information and education, vaccine side effects, and availability of the vaccine. These all should be highlighted so that maximum population gets immunized.

Keywords: COVID-19, healthcare worker, hesitancy, perception, vaccine

Introduction

Social distancing and quarantine may slow down the spread of the virus and flatten the epidemic curve but it may not be sufficient to completely halt the spread of COVID-19.[1] Immunization is one of the most effective health interventions to prevent infectious diseases and thus vaccines against COVID-19 are considered of great importance to prevent and control COVID-19.

In past, immunization has helped to reduce the global burden of illness and death, thus installing public confidence in vaccines has become an important concern.[1]

Maintaining confidence in vaccination depends on the interaction between patients and providers.[1,5] Countries worldwide are trying to accelerate the research and current development of more than 160 candidate vaccines is under evaluation. Indian Council of Medical Research (ICMR) has given emergency use authorization to COVID-19 vaccines and thus a vaccine against COVID-19 is

Address for correspondence: Dr. Pooja A. Baviskar, Department of Biochemistry, Second Floor, College Building, Old Thane Belapur Road, Kalwa, Thane, Maharashtra, India.
E-mail: dr.poojabaviskar@gmail.com

Received: 11-07-2021 **Revised:** 30-11-2021
Accepted: 16-12-2021 **Published:** 30-06-2022

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_1377_21

How to cite this article: Ubale MR, Bagle TR, Gaikwad S, Baviskar PA, Nanoty VA. Attitude and perception of COVID-19 vaccines in healthcare workers. J Family Med Prim Care 2022;11:2448-55.

available for healthcare workers (HCWs).[6] Understanding and investigating the various factors for COVID-19 vaccine along with effective promotion strategies are important for HCWs, family physicians, and primary care providers for COVID-19 vaccine acceptability.

Materials and Methods

A cross-sectional observational study was conducted after obtaining Institutional Clinical Ethics Committee (ICEC) and Institutional Review Board (IRB) permission. Informed consent was taken for both offline and online data entry. The study questionnaire was carried out both offline and online. Online Google forms link was shared through various social media platforms, emails, WhatsApp, etc., The study questionnaire consisted of two parts, the first part being demographic information that consisted of education, designation, working in COVID-19-related duty, whether associated with comorbidity and previously detected as COVID-19 positive. The second part consisted of knowledge, attitude, and perception of healthcare workers toward COVID-19vaccination.

Sample size was estimated by Epiinfo software version 3.0 by sample size formula[7]

Sample size $n = [DE \times Np\ (1 - p)]/[(d^2/Z^2_{1-\alpha/2} \times (N - 1) + P \times (1 - p)]$

where N was population size 1,350, (p) being hypothesized % frequency of outcome factor in the population being 50%, (d) being confidence limits of 5%, and design effect being 1.0.

In a study by Joseph and Joseph, there were around 1,350 healthcare workers (HCWs) employees working in medical colleges, and tertiary care hospitals.[8] The calculations were based on the assumption that 50% of the HCWs will be having a good knowledge, attitude, and practice of chemoprophylaxis at 95% confidence interval, limit of precision being 5%, and design effect of 1.0, where the calculated sample size was 300 participants. A total of 300 HCWs were divided into two groups with Group I (only doctors) having 150 doctors and Group II (HCWs other than doctors)

The inclusion criteria consisted of healthcare workers of both genders with age more than 18 years and less than 65 years to be included in the study. HCWs filling incomplete forms were excluded from the study.

The validity (content and criterion), reliability, i.e., test and retest reliability of the questionnaire, and face validity were done by the faculty members from microbiology, pharmacology, and community medicine. Test-retest reliability was estimated with a subsample of 10 HCWs by giving questionnaire 7 days apart; these were not included in the final analysis. Internal consistency reliability by Cronbach's-alfa coefficient was 0.84.

Descriptive statistical methods were used and data was summarized as percentages and frequencies for categorical variables. Student's unpaired test*t*-test was used for quantitative data while Chi-square and Fisher's exact test were used to determine the relationship between qualitative sociodemographic variables and various aspects of knowledge, attitude, and practice. All data analyses were performed using GraphPad Software version 8.1, La Jolla California USA, www.graphpad.coms.

Questionnaire of knowledge, attitude, and practice toward COVID-19 chemoprophylaxis was prepared on the information available on the Ministry of Health and Family Welfare (MOHFW), ICMR, and WHO websites.[2-4,8-11]

Results

Among the 300 healthcare and frontline workers, 62 (20.67%) (Group I: 49, Group II: 13) were comorbid, 43 (14.33%) had hypertension, 15 (5%) had diabetes mellitus, 22 (7.33%) had diabetes and hypertension, 52 (17.33%) had taken COVID-19 vaccine (Covishield), and 42 (14%) (Group I: 29, Group II: 13) were detected to be COVID-19 positive.

Table 1 gives demographic profile of HCWs. Table 2 gives education and designation of healthcare workers, while Table 3

Table 1: Demographic profile of healthcare workers

	Group I	Group II	*P*
Age (years)	38.49±11.88	24.32±7.01	<0.0001
18-30	42	102	<0.0001
30-40	39	26	
40-50	43	13	
50-60	19	9	
>60	7	0	
Female	72	83	0.203
Male	78	67	
Total Experience (Years)	12.32±11.33	3.71±1.75	<0.0001
Are you Comorbid			
Yes	42	15	<0.0001
No	108	135	
Type of Comorbidity			
HTN	24	13	0.2705
DM	08	02	3.9818
DMHTN	15	02	
Other	01	00	
Worked/Working in COVID-19 related duty in the past 12 months			
Yes	123	72	<0.0001
No	27	78	
Have you been detected COVID-19 positive			
Yes	34	19	0.045
No	116	121	
If yes, how were you detected COVID-19 positive			
RAT	13	08	0.782
RTPCR	21	11	

RAT, rapid antigen test; RT-PCR, real-time polymerase chain reaction

Table 2: Education and designation of healthcare workers

Group I	Number of Participant	Group II	Number of Participant
Education			
MBBS	39	>12	4
MBBS Diploma	8	Graduate	59
MBBS PG	53	Diploma	23
Designation			
Intern	27	Postgraduate	11
Private Practitioner	12	PhD	1
Resident	2	Medical Student	22
Assistant Professor	33	Lab Technician	34
Associate Professor	3	Ward boy	24
Professor	7	Data entry operator	20
Medical Officer	16		

gives knowledge, attitude, and perception of COVID 19 vaccination in HCWs.

Discussion

India is facing COVID-19 pandemic and is currently at the tail end of the second wave in India. There are various medicines tried in the first wave for COVID-19 and there is still ongoing research about medicines; however, in current situation vaccination remains the only source of defense against COVID-19. In India, vaccination is currently provided in HCWs, age above 45 years, and recently started vaccination at age more than 18 years.[11]

In our study, more than 65.67% HCWs were willing to take COVID-19 vaccine and around 18% had taken COVID-19 vaccination. A study from the United States reported that 67% would accept the COVID-19 vaccine, while France documented that about 75% of respondents will use the vaccine when it is available. Nigeria reported acceptability at 29%, while in Saudi Arabia it was at 65% among the general population. In European countries COVID 19 vaccine acceptance rate was at 73.9%, while 7.2% desired not to be vaccinated. Similarly, in a study from Indonesia, 93.3% who agreed for vaccination had 95% of the effect, but 67.0% accepted vaccine with 50% effectiveness, the acceptance of COVID 19 vaccine ranged between 67% to 93%.[12,13] A study by Islam *et al.* in India, reported 79.5% willing to get COVID-19 vaccine when it is available.[14] In a study by Sharun *et al.*, 85% of the 351 subjects were planning to get COVID-19 vaccine once it is available for use in the market.[15] Institut de Publique Sondage d'Opinion Secteur (IPSOS) Worldwide survey had shown vaccination acceptance of 73% globally while it was 87% in Indian population. Thus, differences in COVID-19 acceptance rates ranged in Russia from almost less than 55% to almost 90% in China within the general population.[13,15,16]

In our study, HCWs feel the need to take COVID-19 vaccine so that they can reduce the risk of transmission to family members. Countries like Israel and USA had shown a dramatic reduction in COVID 19 cases.[17] Also, restrictions on the use of masks were made lenient in the US after CDC declared that fully vaccinated individuals, in many situations, do not have to wear a mask.[18]

When the study was conducted the dosing interval between two doses was 28 days, however, guidelines have changed and the gap between Covaxin is 28 days to 42 days while the gap between Covishield is 84 days to 112 days after the first dose.[19]

WHO Immunization Strategic Advisory Group of Experts has defined vaccine hesitancy as a refusal or delay in acceptance of vaccination despite the availability of vaccination services. Vaccine hesitancy has been identified as the top 10 global health threats by WHO.[20] Vaccine hesitancy is multivariable and complex issue needed to be addressed at multiple levels.[13]

Vaccine acceptability may be increased by highlighting various issues about vaccine safety and efficacy preferably by a trusted, centralized source of information.[15] The second wave had a major impact on health and also on the gross domestic product, thus vaccines should be provided at subsidized/affordable rates at the majority of the Government institutes/center to limit the spread of the disease.[13,21]

Previous outbreaks of various infectious diseases like severe acute respiratory syndrome, Swine Flu, Ebola, and Middle East respiratory syndrome had shown that trusted sources of information and guidance are fundamental for disease control.[11] It has been reported that information from government sources has higher levels of trust and is more likely to accept a vaccine. In our study, 66.33% of HCWs get COVID-19 information from the government. Thus, seeking information from authentic government sources has become important to curb the spreading of misinformation.

In our study, 77.4% agreed on the need to follow preventive measures after COVID-19 vaccine. Even though hydroxycholorquine was used for chemoprophylaxis in HCWs, it was discontinued by WHO from COVID-19 treatment.[22,23] The process of vaccine development is a slow and time-consuming process, and has to go through multiple checks for potency, efficacy, and safety, particularly in high-risk individuals like the elderly, people with comorbidities, and immunodeficiencies. The launch of the COVID-19 vaccine has been under emergency use authorization, an accelerated program, with the vaccine going to market in just 9 months after the discovery of the virus, it can be claimed to be the shortest time for a new virus from discovery to the vaccine. There is data to suggest the safety and efficacy of the approved vaccines in the early phase; however, long term efficacy and long-term side effects are largely unknown. In most of the countries, including India, COVID-19 vaccination is voluntary, and therefore it is important to understand the current views of local populations while the vaccination program is being rolled out.[16] In our study, 76.33% feel safety and efficacy are important while 29% feel side effects are a big hurdle to take COVID-19 vaccination but 60% feel the general public will accept COVID-19 vaccine. The most important factor for

Table 3: Knowledge, attitude, and perception of COVID-19 vaccination in HCWs

	Total	HCW	Other	*P*	Chi-square value
What are the types of COVID-19 vaccines? (Multiple options can be marked)					
mRNA (Pfizer, Moderna; America)	277	143	134	<0.0001	53.52
Adenovirus-based (Serum; India)	242	139	103		4
Whole virion inactivated (Bharat; India)	209	116	93		
Recombinant weakened (Sputnik V) (Russia)	116	93	23		
Do not know	22	1	21		
Which type of COVID-19 vaccine will be available in India ? (Multiple options can be marked)					
mRNA (Pfizer, Moderna; America)	68	5	63	<0.0001	176.6
Adenovirus-based (Serum; India)	83	2	81		4
Whole virion inactivated (Bharat; India)	214	141	73		
Recombinant weakened (Sputnik V; Russia)	11	1	10		
Do not know	48	1	47		
While giving COVID-19 vaccine which are the Priority groups (Multiple options can be marked)					
HCWs and frontline workers	278	143	135	0.026	9.205
Elderly above 60 years	180	92	88		3
Comorbidity	129	76	53		
Pregnant Women	42	31	11		
COVID-19 vaccination in India will be					
Voluntary	250	137	113	0.0010	13.86
Mandatory	18	5	13		2
Do not know	32	8	24		
COVID-19 vaccine will help to (Multiple options can be marked)					
Limit the spread of disease to near ones	164	93	71	<0.0001	25.59
Reduce the severity of disease	96	54	42		3
Will prevent from severe COVID-19 infection	83	24	59		
Will help to achieve herd immunity early	45	11	34		
Can COVID-19 positive recovered patient receive COVID-19 vaccine					
Yes	210	139	71	<0.0001	74.02
No	20	4	16		2
Do not know	70	7	63		
How many doses of COVID-19 vaccine will be given in India					
One	5	3	2	<0.0001	22.49
Two	261	143	118		3
Three	10	1	9		
Do not know	24	3	21		
What is the dosing interval between the doses					
15 days	17	4	13	<0.0001	31.40
21 days	27	7	20		3
28 days	224	133	91		
Do not know	32	6	26		
There is need to follow preventive measures such as wearing mask, hand sanitization, social distancing, after receiving COVID-19 vaccine					
Yes	222	131	91	<0.0001	28.20
No	23	7	16		2
Do not know	55	12	43		
How are you getting information about COVID-19 vaccine (Multiple options can be marked)					
Government sources	199	127	72	<0.0001	22.47
Television	175	92	83		3
Social (Whatsapp, Facebook, Twitter)	241	104	137		
Print Media	164	72	92		
When COVID-19 vaccination is started					
I will take the COVID-19 vaccine	191	109	82	<0.0001	56.38
Do not want to take COVID-19 vaccine	12	3	9		3
I have not yet decided	20	8	12		
I will wait to know the side effects and then I will decide	77	30	47		

Contd...

Table 3: Contd...

	Total	HCW	Other	*P*	Chi-square value
Which COVID-19 vaccine will you take					
Any Indian COVID-19 vaccine	32	13	19	0.0003	21.06
Wait for Foreign COVID-19 vaccine	35	11	24		4
I will take any COVID-19 vaccine	191	109	82		
I take vaccine after others have taken the vaccine	30	14	16		
Since I am not going to take vaccine I cannot say	12	3	9		
Which of the following factors make ideal COVID-19 vaccine (Multiple options can be marked)					
Good efficacy	213	129	84	<0.0001	30.74
Good safety	229	126	103		4
No side effect	170	73	97		
Minimal cost	143	52	91		
All of the above	223	131	92		
I am taking COVID-19 vaccine because (Multiple options can be marked)					
I can reduce risk of transmission to my family members	208	124	84	0.0005	17.91
My fear of death will be reduced	41	15	26		3
I will get less severe infection	107	45	62		
COVID-19 vaccine is free of cost	53	36	17		
If I am not be taking COVID-19 vaccine it will be because (Multiple options can be marked)					
I feel by doing COVID-19 work I have lost fear of COVID-19	16	4	12	0.207	4.558
I feel vaccine is developed in less time hence I do not believe in safety	71	29	42		3
The cold chain will not be maintained and vaccine will lose potency	14	2	12		
I feel vaccine has side effects	77	30	47		
Do you feel COVID-19 vaccine should be given free by government					
Yes	185	103	82	0.021	7.703
No	46	22	24		2
Do not know	69	25	44		
Would you like to give vaccine to your family members					
Yes	187	115	72	<0.0001	27.84
No	57	21	36		2
Do not know	56	14	42		
There is no need for vaccination as herd immunity will be developed					
Yes	83	27	56	<0.0001	36.03
No	179	127	52		2
Do not know	63	31	32		
When will antibodies appear after COVID-19 vaccination					
After 1 dose	42	32	10	<0.0001	72.69
After 2 dose	145	89	56		
After 03 months	33	21	12		
Never	80	8	72		
There is still risk of getting infection even after taking complete COVID-19 vaccination					
Yes	148	86	62	0.0004	15.61
No	39	24	15		2
Do not know	113	40	73		
I fear after taking complete dose of COVID-19 vaccine there are lesser chances of being tested positive for COVID-19 by PCR test					
Yes	60	13	47	<0.0001	63.88
No	129	98	31		2
Do not know	111	39	72		
Antigen test/RTPCR for COVID-19 should be done before giving COVID-19 vaccination					
Yes	105	70	35	<0.0001	22.48
No	50	27	23		2
Do not know	145	53	92		
Antibodies test for COVID-19 should be done before giving COVID-19 vaccination					

Contd...

Table 3: Contd...

	Total	HCW	Other	*P*	Chi-square value
Yes	181	72	109	<0.0001	19.07
No	32	21	11		2
Do not know	87	57	30		
Do you think family physicians' recommendation is important for patients to take decision on COVID-19					
Yes	225	106	119	0.031	6.937
No	37	26	11		2
Do not know	38	18	20		
You have been waiting for the COVID-19 vaccine					
Yes	200	108	92	0.082	4.984
No	58	27	31		2
Do not know	42	15	27		
Do you think training for healthcare worker is needed for COVID-19 vaccine administration					
Yes	205	92	113	0.0001	17.82
No	61	45	16		2
Do not know	34	13	21		
Do you think general public will accept the COVID-19 vaccine					
Yes	180	102	78	0.0043	10.92
No	49	15	34		2
Do not know	71	33	38		
Success of COVID-19 vaccination program will depend on acceptance of COVID-19 vaccine by general public					
Yes	264	135	129	0.4412	1.636
No	12	4	8		2
Do not know	24	11	13		
Do you think awareness is needed for COVID-19 vaccine availability and benefits					
Yes	258	139	119	0.0001	19.25
No	25	2	23		2
Do not know	17	9	8		
Do you feel COVID-19 vaccine will end the pandemic					
Yes	76	35	41	0.007	9.924
No	80	52	28		2
Do not know	144	63	81		

vaccine hesitancy is following vaccination the occurrence of mild or serious adverse effects following immunization.

The first sequenced Omicron case was reported from Botswana on November 11, 2021 while in India first case was reported on December 2, 2021. The omicron variant, which was designated a COVID-19 variant of concern by the WHO on November 26, 2021, has triggered travel restrictions as well as a race to accelerate booster vaccination programs. Omicron is expected to be highly transmissible along with antibody resistance.[24-27]

In our study, 62.34% HCWs were ready to give the vaccine to family members while 75% feel that family physician's decision is important to take a decision on vaccination. The health professional's intention to use and recommend the vaccine to their patients depends on their knowledge and attitudes about vaccines.[3,5] In India majority of the patients still rely on family physicians to take major health decisions for their family.[28] A COVID-19 vaccination completed family physician can give a positive message to the general public and will build confidence.

Summary and Conclusion

Today's COVID-19 vaccine acceptance will give an estimate about tomorrow's vaccine demand. In the present scenario, where guidelines are changing frequently, it is important for HCWs to frequently visit the government websites for the latest guidelines. Currently, India is at the fag-end of second COVID-19 wave and the minimum first dose of COVID-19 vaccination needs to be completed to get optimum protection and before the expected third wave.[21]

The majority of the HCWs are ready to accept the COVID-19 vaccination but challenges to motivate them needs to be addressed. It is important to build trust between government agencies and HCWs, family Physicians, primary care providers by conducting CME and various awareness drives.

Through authentic government sources, issues in early vaccine development, side effects, changing duration between the doses, and availability of vaccine needs to be highlighted to improve COVID-19 vaccination acceptance.

Awareness drives should focus to neutralize the misconceptions about COVID-19 vaccination. Vaccine acceptability by HCWs, family physicians, and primary care providers motivate common people to take vaccination and is crucial for mass vaccination, as currently, these remain the only viable option to prevent morbidity and mortality in the upcoming expected third wave. Further studies on the effect of vaccines on the mutant strain, mixing of COVID-19 vaccination for booster dose, target area vaccination, and the need of the booster dose for HCWs needs to be undertaken to modify the COVID-19 vaccination strategies.

Limitations

The study was conducted in a single center and conducted in the timeframe when only two vaccines were available for use. There is a continuous change in COVID-19 vaccine development as well as guidelines. The study included healthcare workers' and frontline worker's views.

Take home message

Healthcare workers, family physicians, and primary care should be encouraged to take vaccines and spread awareness related to vaccines. They can motivate the general population and are the primary health service providers with one-to-one contact with patients as well as the general population.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kabamba NM, Kabamba NL, Ngoie MG, Banza ND, Mbidi MJ, Luhata LC, *et al.* Acceptability of vaccination against COVID-19 among healthcare workers in the Democratic Republic of the Congo. Pragmat Obs Res 2020;29:103-9.
2. WHO Coronavirus Disease (COVID-19) Dashboard. World Health Organization, 2020. Available from: https://covid19.who.int/. [Last accessed on 2021 June 10].
3. Lin Y, Hu Z, Zhao Q, Alias H, Danaee M, Wong LP. Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China. PLoS Negl Trop Dis 2020;14:e0008961.
4. Qiao S, Tam CC, Li X. Risk exposures, risk perceptions, negative attitudes toward general vaccination, and COVID-19 vaccine acceptance among college students in South Carolina. medRxiv 2020:2020.11.26.20239483. doi: 10.1101/2020.11.26.20239483.
5. Lin Y, Hu Z, Zhao Q, Alias H, Danaee M, Wong LP. Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China. PLoS Negl Trop Dis 2020;14:e0008961.
6. Indian council of Medical Research. Emergency use authorization. 2021. Available from: https://www.icmr.gov.in/pdf/press_realease_files/HFW_DCGI_energency_use_authorisation_03012021_2.pdf. [Last accessed on 2021 Jun 10].
7. Dean AG, Arner TG, Sunki GG, Friedman R, Lantinga M, Sangam S, *et al.* Epi Info, a database and statistics program for public health professionals. CDC, Atlanta USA 2011. Available from: https://www.cdc.gov/epiinfo/index.html. [Last accessed on 2021 April 25].
8. Joseph B, Joseph M. The health of the healthcare workers. Indian J Occup Environ Med 2016;20:71-2.
9. Ministry of Health and Family Welfare. Government of India. Available from: https://www.mohfw.gov.in/pdf/Covid19CommunicationStrategy2020.pdf. [Last accessed on 2021 Jun 23].
10. Ministry Of Health and Family Welfare. Government of India. Available from: https://www.mohfw.gov.in/pdf/COVID19VaccineOG111 Chapter 16.pdf. [Last accessed on 2021 June 25].
11. Press Information Bureau. Government of India. Available from: https://pib.gov.in/PressReleseDetailm.aspx?PRID=1712710. [Last accessed on 2021 Jun 21]
12. Bhartiya S, Kumar N, Singh T, Murugan S, Rajavel S, Wadhwani M. Knowledge, attitude and practice towards COVID-19 vaccination acceptance in West India. Int J Community Med Public Health 2021;8:1170-6.
13. Institut de Publique Sondage d'Opinion Secteur (IPSOS). Global attitudes on a COVID19 vaccine. IPSOS Survey for the World Economic Forum. Available from: https://www.ipsos.com/sites/default/files/ct/news/documents/2020-11/global-attitudes-on-a-covid-19-vaccine-oct-2020.pdf. [Last accessed on 2021 Jun 23].
14. Islam F, Agarwalla R, Panda M, Alvi Y, Singh V, Debroy D, *et al.* Assessment of the knowledge, preferences and concern regarding the prospective COVID- 19 vaccine among adults residing in New Delhi, India-A cross sectional study. Family Med Prim Care 2021;10:2369-75.
15. Sharun K, Rahman F, Haritha V, Jose B, Tiwari R, Dhama K. COVID-19 vaccine acceptance: Beliefs and barriers associated with vaccination among the general population in India. J Experiment Biol Agricult Sci 2020;8:S210-8.
16. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, *et al.* A global survey of potential acceptance of a COVID-19 vaccine. Nat Med 2021;27:225-8.
17. Macintyre CR. COVID is surging in the world's most vaccinated country. Why?. Down to earth. Available from: https://www.downtoearth.org.in/blog/health/covid-is-surging-in-the-world-s-most-vaccinated-country-why--77000. [Last accessed on 2021 Jun 22].
18. Centre for Disease Control and Prevention. When you've been fully vaccinated how to protect yourself and others. Available from: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated.html. [Last accessed on 2021 Jun 23].
19. COWIN. Covid vaccine intelligence work. Available from: https://www.cowin.gov.in/faq. [Last accessed on 2021 Jun 29].
20. WHO. [Internet]. Report of the sage working group on vaccine hesitancy. Available rom: https://www.who.int/immunization/sage/meetings/2014/october/1_Report_WORKING_GROUP_vaccine_hesitancy_final.pdf. [Last accessed on 2021 Jun 27].
21. Ecowrap. [Internet]. Revising Fy22 Gdp Estimates To 7.9% (Base Effect At 7.8%): Impact Of Any Possible Third Wave Could Be Significantly Minimised Available from: https://sbi.co.in/documents/13958/10990811/010621-Ecowrap_20210601.pdf/fe475ae5-b0ce-c453-f090-62f0cf548f70?t=1622532682984. [Last accessed on 2021 Jun 30].

22. Bagle TR, Baviskar PA, Ubale MR, Jadhav B, Kshirsagar PP, Vare VA, *et al.* Knowledge, attitude and practice of hydroxychloroquine chemoprophylaxis in health care workers for Covid 19. EJPMR 2021;8:612-9.
23. WHO. WHO discontinues hydroxychloroquine and lopinavir/ritonavir treatment arms for COVID-19. Available from: https://www.who.int/news/item/04-07-2020-who-discontinues-hydroxychloroquine-and-lopinavir-ritonavir-treatment-arms-for-covid-19. [Last accessed on 2021 Jun 10].
24. Vaughan A. Omicron emerges. New Sci 2021;252:7.
25. Chen J, Wang R, Gilby NB, Wei GW. Omicron (B.1.1.529): Infectivity, vaccine breakthrough, and antibody resistance. ArXiv 2021:2112.01318v1.
26. Karim SSA, Karim QA. Omicron SARS-CoV-2 variant: A new chapter in the COVID-19 pandemic. Lancet 2021;398:2126–8.
27. BBC Online. Omicron: India reports first cases of new Covid variant. BBC News December 03, 2021. Available from: https://www.bbc.com/news/world-asia-india-59472675. [Last accessed on 2021 December 11].
28. Kumar P, Kumar R. Rural health scenario – Role of family medicine: Academy of family physicians of India position paper. J Family Med Prim Care 2018;7:1157-62.