

HESITANCY FOR VACCINES AGAINST CORONA VIRUS DISEASE IN NORTHERN INDIA: A CROSS-SECTIONAL STUDY

Chintu Chaudhary¹, Shubham Girdhar², Varinder Singh³, Bhupinder Kaur Anand⁴, Parmal Singh⁵, Firoza Bano⁶

¹Associate Professor, Department of Community Medicine, Al-Falah School of Medical Science and Research Centre, Faridabad, Haryana, India.

²Assistant Professor, Department of Community Medicine, Al-Falah School of Medical Science and Research Centre, Faridabad, Haryana, India.

³Assistant Professor, Department of Community Medicine, Adesh Medical College and Hospital, Mohri, Haryana, India.

⁴Professor and Head, Department of Community Medicine, Adesh Medical College and Hospital, Mohri, Haryana, India.

⁵Associate Professor, Department of Community Medicine, Adesh Medical College and Hospital, Mohri, Haryana, India.

⁶Associate Professor, Department of Community Medicine, Al-Falah School of Medical Science and Research Centre, Faridabad, Haryana, India.

Received : 10/08/2022
Received in revised form : 16/09/2022
Accepted : 25/09/2022

Keywords:
Corona, Cross-sectional,
Hesitancy, India, Vaccine

Corresponding Author:
Dr. Firoza Bano,
Email: dr.fbano@gmail.com
ORCID: 0000-0001-9116-7794

DOI: 10.47009/jamp.2022.4.4.134

Source of Support: Nil,
Conflict of Interest: Nondeclared

Int J Acad Med Pharm
2022; 4 (4); 678-683



Abstract

Background: Severe acute respiratory syndrome novel Beta-Coronavirus (SARS-CoV-2) re-emerged in November 2019 in Wuhan (Hubei, China) and rapidly affected nearly 220 countries across the globe due to its highly infectious nature. The purpose for conducting this study is to estimate current COVID-19 vaccination hesitancy among people residing in these Rural areas. Such type of study has not been done in most of the region of India. It has been assumed that one of the most important hindrances in attaining the goal for herd immunization in order to reduce the burden of the pandemicity is hesitancy and doubtful attitude and behavior regarding vaccine safety among majority of the population worldwide. The objectives are to estimate the prevalence of Covid-19 Vaccination hesitancy and to assess the associated factors in such rural areas. **Materials and Methods:** Cross-sectional study having total participants of 220 were selected by multistage sampling method and interviewed by pretested interview- schedule and collected data were analyzed using SPSS Version 26.0 and Microsoft Excel 2007. **Result:** Out of 220 participants, 72 were estimated as hesitant towards vaccination against Covid-19 (P- value: 0.003). **Conclusion:** A high prevalence of hesitant population was observed which is 34%. Almost all study parameters were detected to be associated in contributing hesitancy towards vaccination against Covid-19.

INTRODUCTION

Severe acute respiratory syndrome Corona Virus-2 (SARS-CoV-2) and novel beta-coronaviruses re-emerged in November 2019 in Wuhan (Hubei, China) and rapidly affected nearly 220 countries across the globe owing to the highly infectious nature of these viruses. The beta-corona viruses have caused three zoonotic outbreaks namely, SARS-CoV(2002-03), Middle East Respiratory Syndrome Corona Virus(MERS-CoV)(2012), and SARS-CoV-2(2019-till date) in the last 2 decades.^[1] Globally the total number of cases have been reported as 10,533,779 on 2 July 2020 with 512,842 mortality.^[2] SARS-CoV-2 is the causative agent for the pandemicity of corona virus disease 2019(COVID-19).^[3] It is a highly contagious virus,

tends to spread this air borne disease by inhalation of the respiratory aerosols, direct human contact and via fomites. The incubation period of the virus ranges from 2-14 days. The symptoms include fever, dry cough, fatigue, shortness of breath, chills, muscles pain, headache, gastric disturbances and weight loss. However, a large population of the infected patients have mild symptoms or asymptomatic. According to WHO, people living with non-communicable diseases (co-morbid conditions) are prone to severe illness due to COVID-19 infection.^[4] The basic strategy globally is reduction of transmission of disease following preventive measures, interventions like wearing masks, sanitization of hands by frequent hand washing with soap and water or maintaining social distancing, travel restrictions, schools closure and

maintaining lockdowns. The most promising strategy to limit the pandemicity in order to reduce the morbidity and mortality rates associated with Covid-19 is specific protection under medical technology which includes safe, effective, affordable and easily accessible vaccines against SARS-CoV-2. Efforts have been initiated towards the development of the vaccines against COVID-19 to reduce the pandemicity and for this purpose, most of the candidate vaccines have been developed using the S-protein of SARS-CoV-2. Vaccination is considered to be one of the greatest achievements of public health. Vaccination campaign have contributed in declining morbidity and mortality. To be successful in reducing the prevalence and incidence of vaccine preventable diseases (VPD), it addresses direct protection for vaccinated individuals, high vaccination coverage rates inducing indirect protection for community or herd immunity, thereby decreasing the risk of infection among susceptibles in the community.^[5] According to WHO: "vaccine must provide a highly favorable benefit-risk contour; with high efficacy, only mild or transient adverse effects and no serious ailments." The vaccine must be suitable for all ages, pregnant, and lactating women and should provide a rapid onset of protection with a single dose and provides safety for at least up to one year of administration.^[6] The current Global priority remains the prevention and treatment of Coronavirus infections. Vaccination for prevention of Covid-19 is the key against Covid-19 pandemic. The World Health Organization (WHO) is currently organizing a global campaign of prevention, early diagnosis, and medical treatment. Along with the ongoing efforts to decline the morbidity and mortality rates due to Covid-19 infection, the development of a COVID-19 vaccine represents the boon for global health organizations.^[7] The efforts in terms of approval of vaccines either Pfizer or AstraZeneca were done on the facts based upon providing herd immunity to the community.^[5] The estimated range threshold for SARS-CoV-2 herd immunity is 50%-67%.^[8] The purpose for conducting this study is to estimate current COVID-19 vaccination compliance rates in terms of hesitancy of Covid-19 vaccination among people residing in rural areas of Faridabad, Haryana. Such type of study has not been done in most of the region of India. It has been assumed that one of the most important hindrances in attaining the goal for herd immunization in order to reduce the burden of the pandemicity is hesitancy and doubtful attitude and behavior regarding vaccine safety among majority of the population worldwide. Vaccine hesitancy was defined by the WHO Strategic Advisory Group of Experts (SAGE) as "delay in acceptance or refusal of vaccination despite availability of vaccination services".^[9] Vaccine hesitancy is complex and context specific, varying across time, place, and vaccines. Vaccine hesitancy occurs along a continuum between full acceptance and outright refusal of all vaccines, i.e.,

when there is acceptance of some and delay or refusal of some of the recommended vaccines. It is influenced by factors such as confidence, convenience and complacency.^[10] Confidence is defined as the trust in the safety and effectiveness of the vaccine, trust in the delivery system as the healthcare system, and the trust in the policymakers.^[11] Moreover, vaccination convenience refers to the relative ease of access to the vaccine that includes physical availability, affordability, and accessibility.^[9] Vaccine complacency is associated with a low realized risk of the vaccine preventable disease and hence more negative attitudes towards the vaccines.^[11] Vaccine hesitancy thus risks the public health consequences of vaccine preventable disease outbreaks. Now it is a challenging approach initiated by government, community leaders and health care workers to reduce hesitancy for Covid-19 vaccines among the community. The results of current study would help the policymakers to undertake well-designed campaigns and strategies by highlighting the importance of vaccination to the community and discouraging vaccine hesitancy, especially by susceptible groups to limit the spread of the disease SARS-CoV-2 stopping further case fatality rate. The main objectives of this study are to

1. To estimate the prevalence of Covid-19 Vaccination hesitancy
2. To assess the associated factors in rural areas of district Faridabad, Haryana, India

MATERIALS AND METHODS

Study Type: A Community based Cross-sectional Study

Study Population: Catchment areas of selected 3 Sub-Centres having a collective population of 37265

Study Area: Study was conducted in field practice areas of Rural Health and Training Centre

Study Duration: Study was conducted from 1st May 2021 to 30th June 2021 for a duration of two months.

Sampling Technique: Multistage Sampling Technique was used while sampling

Sample Size Calculation: The sample size had been calculated using the formula-WHO sample size calculation formula

$$n = 4pq / L^2, \text{ where}$$

n = sample size,

p = Assuming proportion in the population showing the characteristic of interest 50%

$$q = (100 - p)$$

L = Absolute Precision during study considering as 7%

$$n = 4 \times 50 (100 - 50) / 7^2 = 204$$

Considering 95% confidence interval and assuming Prevalence (p) of 50 % and taking "L", Absolute Precision 7%, the minimum sample size was estimated to be 204. Assuming a non-response rate of 10% (approx.), finally we enrolled 220 subjects for the study.

Inclusion Criteria

1. Those head of the family or the elderly member of the family irrespective of gender, willing to participate in study and ready to give consent irrespective of their status of vaccination.
2. Persons aged completed 18 years or more were included in the study if responsible person was not available at the time of interview.

Exclusion Criteria

Those who were not ready to give consent were excluded from the study.

Procedure of Conducting the Study

Using Multistage Sampling Technique, at first stage, Sub-centres were taken as Primary Sampling Units using cluster sampling techniques. There are total 6 Sub-centres under the jurisdiction areas of Rural Health and Training Centre, Kheri Kalan, Faridabad. 6 sub-centres were arranged alphabetically and 3 clusters were made sequentially each having 2 sub-centres. In the second stage, from each cluster, one sub-centre was selected using Simple random sampling by lottery method in order to get 3 sub-centres namely Faridpur, Kherikalan and Mahawatpur having a collective population of 37265 and total household were 5900. In the third stage, by applying systematic random sampling method, every 5th household was chosen till getting about 70 household from areas of each 3 pre selected sub-centres in order to get a total of 220 household. Now from each selected household single person preferably head of the family was interviewed based on the pre-designed and pretested interview-schedule with prior consent and data were collected.

We are exploring the probable factors seemed to be responsible for hesitation towards Covid vaccination. These factors taken are (1) Educational status, (2) Waiting for the next session, (3) Regarding serious adverse effects following vaccination, (4) Fear of contracting breakthrough infection, (5) Safety of vaccines, (6) Effectiveness of the vaccines, (7) Previous infection with Covid-19, (8) Concern with existing Co-morbidity, (9) Fear of Mortality.

Research and publication Ethics

The study was approved by the Institutional Review Board in accordance with the Ethical Committee at Al-Falah University. The authors have no conflicts of interest associated with the material presented in this paper.

Data Analysis

The collected data entered in Microsoft Excel sheet. Statistical analysis was done by Statistical Package for Social Sciences (SPSS), version: 26.0 using

proper statistical tools and techniques. The statistical significance was taken at P value ≤ 0.05 .

RESULTS

Among 220 approached study participants, 72 (34%) were found to be hesitant for Covid-19 vaccination whereas 135 (63%) were favoring vaccination. Only 13 (03%) subjects were totally against this vaccination campaign. Mean value: 1.73; Standard Deviation (SD): 0.562; Variance: 0.316; Chi-square (χ^2): 1.015; Degree of freedom: 2; assuming 95% CI (P-value: 0.003). In terms of their educational status, being hesitant for getting vaccination against Covid-19 are only 4 (2%) belonged to profession group and 11 (5%) from graduate and post graduate study subjects and 8 (4%) among illiterate group. Non-hesitant group for Covid-19 vaccination were found more among study subjects belonging to Intermediate 19 (9%) and primary school educational status 21 (10%) compared to entire study subjects. Regarding waiting for the next coming session, being hesitant for vaccination against Covid-19 are 54 (24%), as compared to 135 (62%) who do not have hesitation for the same. Rest 31 (14%) study subjects are disinterested about this vaccination. Regarding opinion of serious adverse effects following vaccination, being hesitant for getting vaccination against Covid-19 are 52 (24%), as compared to 119 (54%) for whom there is no concern of adverse effects and agree with vaccination. Rest 49 (22%) study subjects are against this vaccination. Concerning opinion of contracting breakthrough infection, people being hesitant for vaccines against Covid-19 are 35 (16%), whereas rest subjects 185 (84%) do not have such opinion. If we consider safety of newly launched vaccine, 165 (75%) being hesitant compared to 08 (04%) who do not have suspicion over safety of vaccine and ready to go with this campaign. Rest 47 (21%) study subjects were having no idea. Majority of the participants, 161 (73%) being hesitant thinking poor efficacy of recently launched vaccine as compared to 07 (03%) do not have hesitation for vaccinated having such opinion. Rest 52 (24%) study subjects were unsure. Regarding opinion of previously infected Covid-19, being hesitant for getting vaccination against Covid-19 are 194 (87%), as compared to 5 (3%) who do not have hesitation. Rest 12 (10%) study subjects are completely disinterested for vaccination. Some people 36 (17%) have opinion of remaining unvaccinated for those already having co-morbidity, as compared to the rest of participants 184 (83%) who do not have such opinion. Regarding mortality following vaccination, very few participants 16 (08%) feel that there is fear of mortality if someone gets vaccine compared to 204 (92%), do not have such feeling.

Table 1: Characteristics of Study Subjects regarding Hesitancy for Vaccination against Covid-19

Variables	N (%)	COVID-19Vaccine Hesitancy			P-value	χ ²	SD	DF
		Yes	No	May be				
Hesitancy for Vaccines	220(100)	72(34)	135(63)	13(03)	0.003	1.015	0.56	2
Educational status	220 (100)	53 (24)	95 (43)	72 (33)	0.001	2.7	1.91	6
	Profession or Honours	14(07)	04(02)	08(04)				
	Graduate/Post graduate	28(13)	11(05)	15(07)				
	Intermediate	43(20)	12(05)	19(09)				
	High School	23(10)	04(02)	16(07)				
	Middle School	26(12)	06(03)	07(03)				
	Primary School	47(21)	08(04)	21(9)				
Illiterate	39(17)	08(04)	09(04)	22(10)				
Waiting for next session	220 (100)	54(24)	135(62)	31(14)	0.002	2.55	0.57	2
Serious adverse effect	220 (100)	52 (24)	119 (54)	49(22)	0.006	4.27	0.67	2
Breakthrough infection	220 (100)	35(16)	185(84)		0.002	1.023	0.36	1
Safety of vaccine	220 (100)	165(75)	08(04)	47(21)	0.003	1.82	0.82	2
Efficacy of vaccine	220 (100)	161(73)	07(03)	52(24)	0.004	3.01	0.86	3
Previously got Covid-19 infection	220 (100)	194(87)	05(03)	21(10)	0.005	2.99	0.60	2
Associated Comorbidity	220 (100)	36(17)	184(83)		0.001	0.99	0.37	1
Fear of mortality	220 (100)	16(08)	204(92)		0.005	1.60	0.26	1

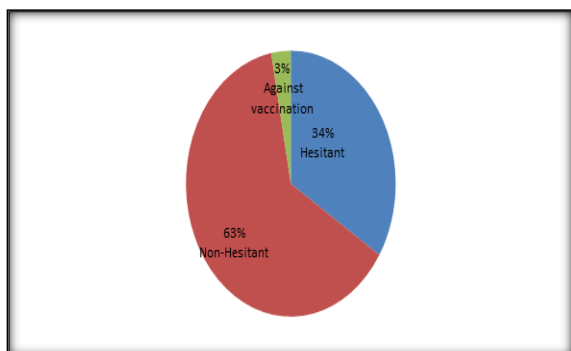


Figure 1: Showing the frequency of hesitation against Covid-19 vaccination among study subjects

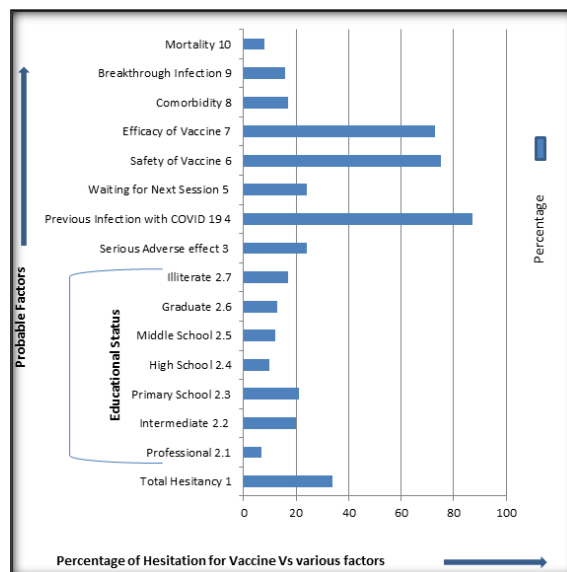


Figure 2: Showing the percentage frequency of hesitation against Covid-19 vaccination against the probable associated factors among study subjects

DISCUSSION

World Health Organization(WHO) identified vaccine hesitancy as a leading global health threat.^[12]In the present study amongtotal 220study participants, about one third,72(34%)are being hesitant for getting vaccination against Covid-19compared to 135(63%)participantsdonot have hesitation for getting the same. Rest 13(03%) study

subjects completely shown disinterest about this vaccination. (χ^2 : 1.015; P-value: 0.003)

In early 2021, a multisource report prepared by Chowdhury-etal estimated that almost one third of Indians were Covid-19 vaccine hesitant.^[13] 13% of Indians were hesitant by Umakanthan-etal.^[14] Vaccine acceptance rate was 87% among Indians by IPSOS survey and three in four adults globally say they would get a vaccine on recommendation.^[15] If we compare our study with a study conducted in the United State, we observed that 30% of the Americans have doubtful attitude.^[16] Meanwhile, an another survey of only adult Americans, 32% study subjects were hesitant or unsure about vaccination.^[17] But a study conducted by Malik-etal found that 67% of the Americans would accept the vaccine if it would be recommended to them.^[18] A Jordanian survey by El-Elimat Tetal revealed that 26.3% population were doubtful receiving COVID-19 vaccines.^[19]

Regarding the educational status of study subjects in our study, it has been revealed that among people from higher educational status professional group (07%), only 02% participants are hesitant for vaccination whereas amongst the illiterate participants (17%) of the total study subjects, only 4% are hesitant for the same. Similarly, few other related studies supporting the fact that higher educational status was associated with no hesitation of covid-19 vaccination in India, France and Germany. Conversely, low educational status groups were found less hesitant for vaccination in United Kingdom, Spain and Canada.^[20] In the year 2020, according to the study by Bhartiya S-etal, the probable reason for hesitancy might be increased illiteracy rate (>30%) and the time of conduct of the previous study (October 2020).^[21] An important possible reason for hesitancy towards covid-19 vaccination campaign might be waiting for the next session. Here 24% study subjects are hesitating and unable for immediate decision for vaccination. The reason behind delayed attitude was to notice any untoward effects of vaccines among beneficiaries.^[22] Here 24% participants were hesitant owing to suspicion over getting serious adverse effects following vaccination. Study by Sharun Ketal, majority were anxious over adverse reactions.^[23] In present study, those having opinion of contracting breakthrough infection following vaccination shots are 16% compared to the study by Chandani-Setal justifies similar opinion by majority (63%) of participants.^[24] Cases of Covid-19 were shown to be inclined despite having more than 60% vaccinated population. Regarding the suspicion over safety of vaccines being hesitant are 75%. This vaccination campaign offers not only direct protection for vaccinated but also provides indirectly to herd immunity to unvaccinated groups. The vaccine seemed to offer only 22% protection against development of non-severe COVID-19 diseases. Here regarding efficacy of vaccine, being hesitant are 73% saying poor efficacy of newly

launched vaccines. A study in United Kingdom shows that single dose of COVID-19 vaccine reduces risk of transmitting SARS-CoV-2 to their closest contacts by 50%.^[5] The researchers Cavanaugh-Aetal, estimated that Covid-19 vaccine was effective by 86.5% and 87% among resident doctors and health care workers respectively resulting in preventing severity and hospitalization.^[25] About 87% opined that previously infected with Covid-19 diseases getting severity on vaccination. Only 17% people concerned about existing co-morbidity will bring mortality, whereas 8% had opinion of bringing mortality following vaccination irrespective of co-morbidity.

Recommendations

To decrease the vaccine hesitancy among community or population group, we have to be active along with health care workers over social media using modern technologies to identify rumors and myths against the COVID-19 vaccines. They should be correlating with scientific facts with evidence and example setting in terms of the safety and efficacy, serious adverse reactions, morbidity and mortality of the vaccines. Inspiration to get vaccinated, doctors' opinion and their experience after getting themselves vaccinated can be shared through social media and mass media. Most importantly, messages to be transmitted to the community regarding the facts of reducing the severity of disease courses leading to declined pattern of morbidity, hospitalization and mortality. Since a higher vaccination rate is the key factor to achieve herd immunity, mass people must be inspired to get vaccinated. This research will help the policymakers make an effective vaccination strategy for a greater uptake rate of vaccines in a bid to control the COVID-19 pandemic.

Acknowledgements

The authors are thankful to all participants for their cooperation and college authorities for giving permission and their helping attitude to conduct the study smoothly.

CONCLUSION

Finally, it has been concluded that the proportion of study respondents reported to be hesitant for Covid-19 vaccines are 34% with P-value: 0.003, which is far less than 0.05. Among those hesitant to take Covid-19 vaccines (34%), the probable reasons concluded for their hesitancy in descending order of frequency were: Opinion of previously got infected through Covid-19 (87%) (P-value: 0.005), doubtful attitude towards safety and efficacy of newly launched vaccine against Covid-19 (75%) and (73%) respectively (P-value: 0.003 and 0.004), fear of getting serious adverse effect following vaccination (24%) (P-value: 0.006),

waiting for the next coming session (24%)(P-value:0.002), risk of having Co-morbidity(17%)(P-value:0.001), fear of getting breakthrough infection (16%)(P-value:0.002), fear of mortality following vaccination(08%)(P-value:0.005), their educational status belonging to profession group(02%) and amongst who were illiterate (04%)(P-value:0.001). Thus all associated factors for this hesitancy also show P-values far less than 0.05. These statistical data indicate that study is statistically significant. Several studies also shown that COVID-19 vaccine may lead to only seasonal protection from the disease SARS-CoV-2. The only vaccination campaign may not be helpful for eradicating the disease. However, it can decrease the morbidity and mortality of the disease.

REFERENCES

- RabaanAA, Al-Ahmed SH, Sah R, Tiwari R, Yattoo MI, Patel SK, et al. SARS-CoV-2/COVID-19 and advances in developing potential therapeutics and vaccines to counter this emerging pandemic. *Ann ClinMicrobiolAntimicrob.* 2020;19(1):40. doi: 10.1186/s12941-020-00384-w.
- Ollarves-Carrero MF, Rodriguez-Morales AG, Bonilla-Aldana DK, Rodriguez-Morales AJ. Anosmia in a healthcare worker with COVID-19 in Madrid, Spain. *Travel Med Infect Dis.* 2020;35:101666. doi: 10.1016/j.tmaid.2020.101666.
- LechienJR, Chiesa-Estomba CM, Fakhry N, Ayad T, Saussez S. In Reference to Anosmia and Ageusia: Common Findings in COVID-19 Patients. *Laryngoscope.* 2020;130(9):E504-E505. doi: 10.1002/lary.28841.
- Perri M, Dosani N, Hwang SW. COVID-19 and people experiencing homelessness: challenges and mitigation strategies. *CMAJ.* 2020;192(26):E716-E719. doi: 10.1503/cmaj.200834.
- ScarboroughLefebvre CD, Terlinden A, Standaert B. Dissecting the indirect effects caused by vaccines into the basic elements. *Hum VaccinImmunother.* 2015;11(9):2142-57. doi: 10.1080/21645515.2015.1052196.
- Kaur SP, Gupta V. COVID-19 Vaccine: A comprehensive status report. *Virus Res.* 2020;288:198114. doi: 10.1016/j.virusres.2020.198114.
- Callaway E. The race for coronavirus vaccines: a graphical guide. *Nature.* 2020;580(7805):576-577. doi: 10.1038/d41586-020-01221-y.
- Omer SB, Yildirim I, Forman HP. Herd Immunity and Implications for SARS-CoV-2 Control. *JAMA.* 2020;324(20):2095-2096. doi: 10.1001/jama.2020.20892.
- MacDonald NE; SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. *Vaccine.* 2015;33(34):4161-4. doi: 10.1016/j.vaccine.2015.04.036.
- Larson HJ, Jarrett C, Schulz WS, Chaudhuri M, Zhou Y, Dube E, et al. Measuring vaccine hesitancy: The development of a survey tool. *Vaccine.* 2015;33(34):4165-75. doi: 10.1016/j.vaccine.2015.04.037.
- French J, Deshpande S, Evans W, Obregon R. Key Guidelines in Developing a Pre-Emptive COVID-19 Vaccination Uptake Promotion Strategy. *Int J Environ Res Public Health.* 2020;17(16):5893. doi: 10.3390/ijerph17165893.
- Grewal M, Mushtaq A, Chopra T. "It's worth a shot... or is it?" Notes from the grassroots on vaccine hesitancy and bridging gaps. *Infect Control HospEpidemiol.* 2021;1-3. doi: 10.1017/ice.2021.356.
- PullanS, Dey M. Vaccine hesitancy and anti-vaccination in the time of COVID-19: A Google Trends analysis. *Vaccine.* 2021;39(14):1877-1881. doi: 10.1016/j.vaccine.2021.03.019.
- Francis AI, Ghany S, Gilkes T, Umakanthan S. Review of COVID-19 vaccine subtypes, efficacy and geographical distributions. *Postgrad Med J.* 2022;98(1159):389-394. doi: 10.1136/postgradmedj-2021-140654.
- Zhou Z, Zhu Y, Chu M. Role of COVID-19 Vaccines in SARS-CoV-2 Variants. *Front Immunol.* 2022;13:898192. doi: 10.3389/fimmu.2022.898192.
- AsresF, Umeta B. COVID-19 vaccines: awareness, attitude and acceptance among undergraduate University students. *J Pharm Policy Pract.* 2022;15(1):32. doi: 10.1186/s40545-021-00397-6.
- Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes Toward a Potential SARS-CoV-2 Vaccine : A Survey of U.S. Adults. *Ann Intern Med.* 2020;173(12):964-973. doi: 10.7326/M20-3569.
- Malik AA, McFadden SM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. *E Clinical Medicine.* 2020;26:100495. doi: 10.1016/j.eclinm.2020.100495.
- El-Elimat T, AbuAlSamen MM, Almomani BA, Al-Sawalha NA, Alali FQ. Acceptance and attitudes toward COVID-19 vaccines: A cross-sectional study from Jordan. *PLoS One.* 2021;16(4):e0250555. doi: 10.1371/journal.pone.0250555.
- Lazarus JV, Wyka K, Rauh L, Rabin K, Ratzan S, Gostin LO, et al. Hesitant or Not? The Association of Age, Gender, and Education with Potential Acceptance of a COVID-19 Vaccine: A Country-level Analysis. *J Health Commun.* 2020;25(10):799-807. doi: 10.1080/10810730.2020.1868630.
- SamantaS, Banerjee J, Kar SS, Ali KM, Giri B, Pal A, et al. Awareness, knowledge and acceptance of COVID-19 vaccine among the people of West Bengal, India: A web-based survey. *Vacunas.* 2022;23:S46-S55. doi: 10.1016/j.vacun.2022.01.002.
- Schwarzinger M, Flicoteaux R, Cortarenoda S, Obadia Y, Moatti JP. Low acceptability of A/H1N1 pandemic vaccination in French adult population: did public health policy fuel public dissonance? *PLoS One.* 2010;5(4):e10199. doi: 10.1371/journal.pone.0010199.
- NarapureddyBR, Muzammil K, Alshahrani MY, Alkhatami AG, Alsabaani A, AlShahrani AM, et al. COVID-19 Vaccine Acceptance: Beliefs and Barriers Associated with Vaccination Among the Residents of KSA. *J MultidiscipHealthc.* 2021;14:3243-3252. doi: 10.2147/JMDH.S340431.
- ChandaniS, 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 BehavImmun Health.* 2021;18:100375. doi: 10.1016/j.bbih.2021.100375.
- Rosenberg ES, Dorabawila V, Easton D, Bauer UE, Kumar J, Hoen R, et al. Covid-19 Vaccine Effectiveness in New York State. *N Engl J Med.* 2022;386(2):116-127. doi: 10.1056/NEJMoa2116063.