Original research article

Vaccine Perception: Acceptance, Hesitancy, Beliefs And Barriers Associated With COVID-19 Vaccination Among Medical Students.

Dr Afshan Kausar[1], Dr Shaikh Shaista Parveen[2], Uzma Afreen[3], Dr Syed MaazHussain[4]

[1] Associate Professor Department of Physiology, JIIUS Indian Institute of Medical Science and Research, Warudi, Badnapur, Jalna, Maharashtra

[2] Assistant Professor Department of Biochemistry, JIIUS Indian Institute of Medical Science and Research, Warudi, Badnapur, Jalna, Maharashtra

[3]Assistant Professor Department of Microbiology, JIIUS Indian Institute of Medical Science and Research, Warudi, Badnapur Jalna, Maharashtra

[4] Associate Professor Department of Pharmacology, JIIUS Indian Institute of Medical Science and Research, Warudi, Badnapur, Jalna, Maharashtra.

Corresponding Author: Dr Syed Maaz Hussain.

E-mail: drmaaz4u@gmail.com

Abstract

Introduction: COVID-19 vaccines have emerged as a key strategy, being the most effective public health intervention in preventing the massive humanitarian crisis. Thus, as a part of preventive measure, government of India had launched COVID-19vaccines on 16 January 2021.Indeed vaccine hesitancy is one of the most significant barriers for success of any immunization drive. Hence, in view of the recent surge in Covid19 cases in our country, this study was planned to assess the awareness, hesitancy and acceptance attitudes ofCOVID-19vaccine among Medical Students (MS) of Maharashtra.

Methodology: This was a cross sectional study. Data was collected using self-reported, structured questionnaire from 356 MS through online Google form. Data were extracted, transferred and analysed using appropriate statistical tool.

Results: The study reported 83.43%vaccine acceptance and 16.57% of hesitancy among MS. Furthermore, the main source of COVID-19 vaccine information was social media followed by government web sites. Majority 91.57% of the students were aware of different types of COVID-19vaccines available in our country. However 62.62% MS among acceptance group were willing to get vaccinated through college or university health centre. Beside the main reason for hesitancy was fear of adverse reactions. Moreover the hesitant group was uncertain about safety and efficacy of available vaccines.

Conclusion: High acceptance was shown among MS regarding COVID-19 vaccine; however, it is critical to alleviate uncertainties among hesitant MS by continuous education, encouragement and motivation. Consequently, planning and implementation of strategies to further amplify the vaccination rate among medical student is vital to augment the COVID-19 vaccination drive in our country.

Keywords: COVID-19 vaccines, Vaccine hesitancy, vaccine acceptance.

Introduction

COVID-19 pandemic is considered as a worldwide challenge with enormous burden on health care system because of high morbidity and mortality. Furthermore, it has adversely affected not only the health but also global economy. Specifically the South east Asian countries are put up with major threat .[1]India continues to report nearly 47,092new cases dated 1 September 2, 2021 as country gears up to fight up the possible third wave of COVID-19 infection. Till 10 September 2021, 21.9 crore people were already affected and 4. 55 million COVID-19 deaths reported in the world and in India, the cumulative positive cases now stand at approximately 3.32 crore.[2]

Indeed the pandemic has affected many corners of human life. Restoring it back to normalcy demands promising strategies on various fronts from testing, treatment to prevention. Essentially COVID-19 vaccines has emerged as a key strategy[3] being the most effective public health intervention in preventing the massive humanitarian crisis. Thus as a part of preventive measure, government of India had launched COVID-19vaccines on 16 January 2021[4]. The first phase had targeted health care workers (HCW) including medical students for vaccination with either of the two approved vaccines – Covishield or Covaxin. However, to control the pandemic adequate acceptance and willingness to take vaccine is essential. Thus availability of vaccine in conjunction with its acceptance by public is the key in thriving vaccine drive. Vaccine demand and acceptance are multifactorial in nature varying across place, time and behavioural nature of the public. [5-12]

"Despite the availability of vaccination services; delays in acceptance or refusal of vaccination" is known as Vaccine hesitancy.[13]Vaccine hesitancy is one of the most significant barriers for success of any immunization drive. Furthermore HCWs are recognized to play a decisive and influential role in encouraging vaccine acceptance among the hesitant individualls.[14]Health care providers are expected to be well-versed about any adverse reactions and efficacy of new vaccine in the market. Furthermore public health personnel, government's officials and advocacy groups should be prepared to deal with hesitancy of public towards vaccination, educate and motivate them so that they will accept immunization.

Since doctors are a reliable source of health information, their acceptance or rejection, can influence the general population's perception towards COVID-19 vaccines. Similarly high vaccination coverage among medical students is desired because they are not only frontline workers but also future physicians, providing COVID-19care in high burden situations[15]. In fact, studies are reported in countries like Egypt[16], US[17] [18] and China [19]among HCW showing vaccine perception, but very few studies are done in India among medical students[20].

Vaccine hesitancy is a limiting step in attempts of controlling the current pandemic. Thus to improve vaccine acceptance among general population, the health care workers especially medical students who are the future physicians should not be hesitant to receive vaccine. Therefore, in view of the recent surge in COVID-19 cases in our country, this study was planned to assess the awareness, hesitancy and acceptance attitudes of COVID-19 vaccine among medical students of Maharashtra. The study findings will address the perception of medical students towards COVID-19 vaccination and will be helpful in improvising planning for delivering the vaccination to a wider population.

Objectives of study

I.   To Determine the COVID-19 vaccine perception; acceptance, hesitancy, beliefs and barriers among medical students of Maharashtra, India

II. To improve vaccine awareness among medical students, educate and motivate them to get vaccinated.

Method;

This cross-sectional study was conducted among medical students of JIIU'S Indian Institute of Medical Science And Research from 1July – 14 July 2021.Being a descriptive survey, the sample size was calculated as per Cochran's formula which yielded a sample size of 384 individuals corresponding to the 50%, prevalence, relative precision of 25% and alpha value of 5%.Data tool utilized was a self-reported, structured questionnaire prepared using evidence from prior studies on vaccine perception among medical students[17] and in general population .[21,22] Procedure and purpose of the study was informed and explained to participants and informed consent was taken for filling the online survey questionnaire.

Data was collected via an online Google forms through social media platform of what's app mainly. Students who completed the survey were not offered any financial or other kind of rewards. The identity and information of the participant was assured high confidentiality. The study was approved by institutional ethical committee.

Data analysis:

Data through online Google forms was extracted, transferred and analysed by using Microsoft excel. All the categorical variables (gender, professional year, vaccine acceptance etc) were described as frequencies and percentages. Chi square test was performed as test of significance with $p \leq 0.05$ considered significance.

Results:

Out of 384, 356 medical students (MS) had given consent and completely filled the online survey questionnaire with a response rate of *92.70%.* Majority were female (59.81%) as compared to males (40.15%).Table I had depicted demographic details. The mean age of the students was 21.76 ± 2.3 years. The response to the question 'Are you willing to take the COVID-19 vaccine ' 83.43% of students replied as 'yes'(acceptance) while 10.32 % 'no' and 6.25 % 'maybe', Therefore, vaccine hesitancy was found 16.57% (Graph 1).The rate of acceptance among female MS was 85%, while it was 83% in males(Graph 2).The phase wise distribution as in graph 3 shows that the phase IV, II & III had greater acceptance in contrast to phase I MS having least (75%).Furthermore the difference was found to be statistically significant ($P<0.05$).
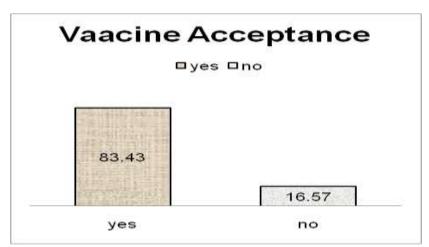
112 and 24 had experienced the symptoms of COVID-19, among the acceptance and hesitant respectively.314 out of 356 MS had undergone COVID-19 testing. 225 and 33 had trusted the information from government and public health experts among acceptance and hesitance groups respectively. Noticeably very few (69) in acceptance group believed that natural immunity is sufficient to protect them against COVID-19 infection, the difference between two groups was found to be statistically significant ($p< 0.01$). Majority of the students (326) were aware of different types of COVID 19 vaccines available in our country. 186 MS among acceptance group were willing to get vaccinated through college or university health centre but 86 were not sure about their commitment for the same. Table II shows details of comparison between acceptance and hesitant groups related to various questions of our survey. The Determinants of hesitancy among participant is given in graph 4.
Sources of information;

The main source of COVID-19vaccine information was social networking sites (Facebook, WhatsApp, YouTube, Instagram) 65.17%) followed by official websites of WHO,MOHFW and GOI , (20.84%).8.2% participants reported that they got the information through television
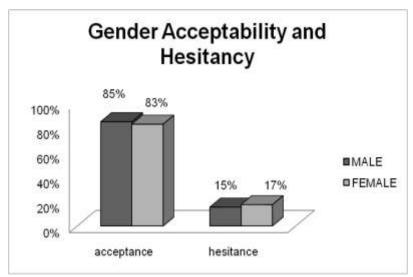
while 4.4% through print media (magazines, newspapers). Very few got information by mobile caller tune.FIGURE 1
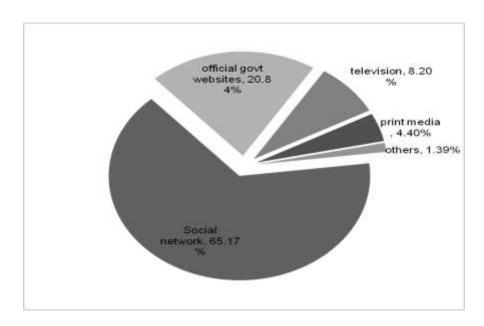
Table I: Demographic profile of participant;

Variables		Number of participants n=356	Percentage(%)
Age (In years)	18 to19	54	15%
	20-21	131	37%
	22-23	113	32%
	>23	58	16%
Gender	Male	143	40.16
	female	213	59.81
Academic level MBBS	Phase I	86	25%
	Phase II	88	25%
	Phase III	93	26%
	Phase IV	89	24%
Residence	Urban	279	78%
	Rural	77	22%

Graph 1: Vaccine acceptance (%) among MS.

Graph 2: Gender distribution of acceptance and hesitancy.
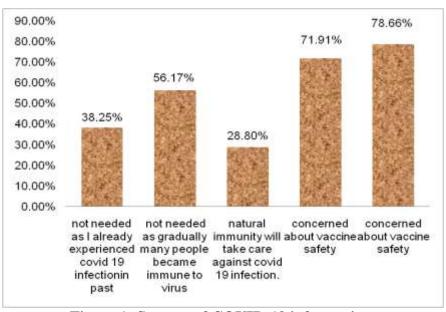
Graph 3: PHASE WISE ; ACCEPTANCE AND HESITANCE

Figure 1; Sources of COVID-19 information.

Table II: Frequency distribution and chi-square analysis of the vaccine acceptance and hesitant group.

Variables	Response	Acceptance group: 297(83.43%)	Hesitant group: 59 (16.57%)	P value
Professional year of MBBS	I	69 (23.23%)	17 (28.81%)	0.004*
	II	66 (22.22%)	22 (37.28%)	
	III	78 (26.26%)	15 (25.42%)	
	IV	84 (28.28%)	5 (8.47%)	
Experienced symptoms of Covid 19	Yes	112 (37.71%)	24 (41.67%)	0.66
	No	185 (62.20%)	35 (59.32%)	
Undergone Covid 19 testing	Yes	265 (89.22%)	49 (83.05%)	0.17

	No	32 (10.77%)	10 (16.94%)	
Tested positive for Covid 19	Yes	40 (13.46%)	7 (11.26%)	0.70
	No	257 (86.53%)	52 (88.13%)	
Family members tested positive	Yes	106 (35.69%)	14 (23.72%)	0.07
	No	191 (64.30%)	45 (76.27%)	
Trust the information from the government or public health experts.	Yes	225 (75.75%)	33 (55.93%)	0.001*
	No	72 (24.24%	26 (44.06%	
Will natural immunity take care against COVID-19	Yes	69 (23.23%)	31 (52.54%)	0.00001*
	NO	228 (76.76%)	28 (47.45%)	
Aware of different types of COVID-19 vaccines available.	Yes	272 (91.58%)	54 (91.52%)	0.84
	NO	25 (8.41%)	5 (8.47%)	
Aware of adverse reaction of the vaccines	Yes	247 (83.16%)	46 (77.96%)	0.62
	NO	50 (16.83%)	13 (22.03%)	
Know measures and precautions to be taken after COVID-19 vaccination.	Yes	222 (74.74%)	43 (72.88%)	0.76
	No	75 (25.25%)	16 (27.11%)	
Vaccination will allow to get back to normal.	Yes	100 (33.67%)	9 (15.25%)	0.009*
	No	27 (9.09%)	10 (16.94%)	
	May be	170 (57.23%)	40 (67.79%)	
Willing to get vaccinated; If the COVID-19 vaccine made available through your college/university's health centre.	Yes	186 (62.62%)	10 (16.92%)	0.00001*
	No	25 (8.41%)	14 (23.72%)	
	May be	86 (28.95%)	35 (59.32%)	
Are you concerned about vaccination of the member of your household?	Yes	214 (72.05%)	27 (45.76%)	0.0001*
	NO	32 (10.77%)	9 (15.25%)	
	Neutral	51 (17.17%)	23 (38.98%)	
Vaccine preferred.	Covishield	145 (48.82%)	17 (28.81%)	0.041*
	Covaxin	62 (20.87%)	16 (27.11%)	
	No preference	38 (12.79%)	10 (16.94%)	
	Not having enough knowledge	52 (17.15%)	16 (27.11%)	
	NO	72 (24.24%)	26 (44.06%)	
COVID-19 vaccine could help to reduce severe COVID-19 disease?	Yes	274 (92.25%)	40 (67.79%)	0.00001*
	NO	23 (7.70%)	19 (32.20%)	

NOTE; COVID-19, corona virus disease 2019, p≤ 0.05 considered significant.

Discussion:
Our study estimated approach of MS with regards to COVID-19 vaccination in rural medical college of Maharashtra. The findings can be employed for projection of vaccination drive in future. Approximately 83.42% medicos were willing for getting vaccinated. Our finding of

acceptance rate is slightly lower than national surveys conducted by Jyoti et al [20] but higher (77%) than survey conducted in other part of the world.[17]

Similar studies were performed in various parts of the world on the healthcare workers. The findings of these studies suggested that the acceptance rate of COVID-19 vaccine is different in each country.

Shaw et al. performed similar study in the United States and found that about 58% of health care workers had the intention to receive COVID-19 vaccines.[23] Qattan et al done similar study in healthcare workers of Saudi Arabia.[24] In their study total 736 healthcare workers began the online questionnaire and 673 completed it (a 91.44% completion rate). Among the study participants, 50.52% were willing to have the COVID-19 vaccine, of which 49.71% intended to have the vaccine as soon as it becomes available in the country, while 50.29% would delay until the vaccine's safety is confirmed.

Agyekum et al[25] examined the acceptability of COVID-19 vaccines among health care workers in Ghana. Their findings showed that approximately 39% of health care workers in Ghana intended to receive the COVID-19 vaccines if available. In Nzaji et al.[26] study in the Democratic Republic of Congo found that approximately 27.7% of health care workers were willing to receive the COVID-19 vaccines if available. Wang et al. [27] found that about 40% of nurses in Hong Kong had the intention to accepting the COVID-19 vaccine.

In the multicountry study of Verger et al.[28], which also assessed health care workers' attitudes towards COVID-19 vaccination in France, Belgium, and Canada, it was found that approximately 40% of health care workers in Belgium (Wallonia and Brussels) were willing to vaccinate themselves if COVID-19 vaccines were available.

We found that majority of the students were aware of symptoms and signs related to COVID-19 and 38.20% had experienced those symptoms and among these students 34.5% tested positive by RT-PCR. In majority of the cases, family members also of the students who tested positive were documented as RT PCR positive.

In response to statement 'Are you willing to take vaccine' 6.25% reported as 'maybe' suggesting that they were not sure of getting vaccinated. Thus, in order to accept the vaccination drive, these students need further encouragement and reassurance regarding vaccine. In view of addressing these issues; factual, rational and realistic vaccine information must be passed on to them. Evidence-based strategies could be utilized for enhancing vaccine acceptance to effectively educate, motivate, encourage and reinforce the role of vaccine benefits specifically for community protection[29]. A recent study indicated that perceived community benefit was associated with respondents' intention to receive a COVID-19 vaccine.[30] Thus, vaccination not only protects one who receives it but also benefits others in the family, friends and ultimately the entire society. Eventually community protection creates barrier for global infection dissemination.

In our study, Covishield was preferred among all available COVID-19 vaccines. Acceptance perhaps inclined with precise knowledge concerned with the disease as well as efficacy of the vaccine. Whilst general observation illustrates that different type of vaccine corroborate varied efficacy pattern, consequently selection of the proper vaccine type amongst all the available ones is essential, demanding accurate knowledge.[31]

Moreover this study has found that 77% of students in the hesitant groups were concerned of adverse reaction. This was combined with the anxiety of long term as well as short term adverse effects. The concern of MS might be that the vaccines had not been tested rigorously enough to decide all probable adverse effects and efficacy accurately. Thus vaccine's safety and efficacy were the most important predictors of vaccine refusal.

Predominant information narrated in the media can also distort persons' perception regarding what the majority of people believe and put into practice[32]. Social influence plays a vital role in deciding about vaccine acceptance. Thus vaccination decision is affected by individuals social networks including family members and friends, in addition to the other sources of information they seek advice from. Hence the role of social media and internet as an information basis of health demeanour has proved to be progressively vital for medicos.[20]The possibility of vaccine acceptance was found less if many people in one's social network fail to recommend for it[33]. On the other end, support from people that an individual trusts has been found to enhance vaccine uptake [34].

For both the vaccine hesitance and acceptance groups; social, internet, and print media were the well-known source of COVID-19vaccine.The observed hesitancy rate could be explained by two probable reasons. First, at the time when study was conducted the spread of anti-vaccine misinformation on various social media platforms was on high intensity and heaped out, and this might have created doubt about the novel vaccine in young minds. Secondly confirmed new COVID -19 cases in the country had started to turn down at the time of data collection which may perhaps resulted in alleviated fears of infection and reflected as weaker intention to get vaccinated. However majority believes that vaccination could be beneficial for reducing rate of the severe covid19 disease. Thus morbidity as well as mortality may perhaps be declined by high immunization coverage.

Our findings are consistent with Jyotiet al[20]which presented; concerns regarding safety followed by its efficacy are major factors responsible for vaccine hesitancy. For addressing this issue, various interventions and strategies like effective communication, counselling sessions and lectures need to be designed. This will surely motivate the young generation to make a choice of reliable, trustworthy & authentic source of vaccine information.

Majority of those choosing to be vaccinated intended to take vaccine from government supply indicating their trust on government. At the same time they were also concerned about getting their family members vaccinated. Most of the students in acceptance group desired for reopening offline classes and clinical postings in perspective of getting individual lives back to normalcy. Thus, vaccination could build confidence helping the students resume pre COVID scenario of easy life as compared to restricted life during pandemic. Students were concerned about the delaying of their exams, and prolongation of professional education time frame.

Moreover, this study provides useful information on vaccine perception among medicos in Maharashtra which would be beneficial in designing successful COVID-19 immunization strategy by public healthcare providers. Besides more strategies must be introduced to disseminate the knowledge and diminish the fear of vaccination among medicos. Government needs to integrate various education strategies taking into consideration the characteristics and variables of various organizations.

The COVID-19 vaccination hesitancy could negatively influence the implementation of mass vaccination programs; therefore, information concerning the perception of vaccines among MS

would be assisting and valuable to design appropriate educational programs. Thus their perceptions on vaccine safety can facilitate government to establish early and appropriate strategies to augment vaccination amongst public.

Limitation;

The hesitance and acceptance patterns may perhaps change as more information on COVID -19 vaccines will be available over time. Moreover in this period of pandemic, new information added daily may influence respondent's perception of vaccine acceptance. Convenient sampling technique utilized in our study limits our findings to be generalized

Conclusion:

The study found positive attitude towards vaccine acceptance. High acceptance was shown among MS regarding COVID-19 vaccine. The level of vaccine acceptance is expected to be one of the chiefs resolving factors in the COVID-19 pandemic. The current findings exhibit that COVID-19 vaccine acceptance among MS is influenced by varied factors such as; academic level, age, perceived vaccine beliefs etc. Accordingly, it is critical to alleviate uncertainties among medicos by continuous education, encouragement, motivation and communication strategies tailored to students' health beliefs that persuade vaccine acceptance. The planning and implementation of strategies to increase the vaccination rate among medicos is vital to augment the COVID -19 vaccination drive in our country.

Budget; non funded

References;
1. Bhutta ZA, Basnyat B, Saha S, Laxminarayan R. Covid 19-19 risks and response in South Asia. BMJ 2020;368:m1190
2. https://www.google.com/search?client=firefox-b-d&q=total+cases+of+corona+in+world dated 10/09/2021.
3. Kumar VM et al. (2021) Strategy for COVID 19-19 vaccination in India: the country with the second highest population and number of cases. NPJ Vaccines 6, 60.
4. mohfw (2021) Frequently asked questions: COVID 19-19 vaccination. New Delhi: Ministry of Health and Family Welfare, Government of India. Available at https://www.mohfw.gov.in/Covid 19_vaccination/vaccination/ index.html (Accessed May 2021)
5. Al-Mohaithef M, Padhi BK. Determinants of COVID 19-19 Vaccine Acceptance in Saudi Arabia: A Web-Based National Survey. *J MultidiscipHealthc*. 2020;13:1657-1663. Published 2020 Nov 20. Doi:10.2147/JMDH.S276771
6. Larson, H. J., Jarrett, C., Eckersberger, E., Smith, D. M. D. & Paterson, P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. Vaccine 32, 2150–2159 (2014).
7. Habersaat KB, Jackson C. Understanding vaccine acceptance and demand – and ways to increase them. *BundesgesundheitsblattGesundheitsforschungGesundheitsschutz*. 2020;63(1):32–39. Doi:10.1007/s00103-019-03063-0 [PMC free article] [pubmed] [crossref] [Google Scholar]
8. Setbon M, Raude J. Factors in vaccination intention against the pandemic influenza A/H1N1. *Eur J Public Health*. 2010;20(5):490–494. Doi:10.1093/eurpub/ckq054 [PMC free article] [pubmed] [crossref] [Google Scholar]
9. Wilson K, Nguyen HH, Brehaut H. Acceptance of a pandemic influenza vaccine: a systematic review of surveys of the general public. *Infect Drug Resist*. 2011;4:197. Doi:10.2147/IDR.S23174 [PMC free article] [pubmed] [crossref] [Google Scholar]

10. Larson HJ, Clarke RM, Jarrett C, et al. Measuring trust in vaccination: a systematic review. *Hum VaccinImmunother.* 2018;14(7):1599–1609. Doi:10.1080/21645515.2018.1459252 [PMC free article] [pubmed] [crossref] [Google Scholar]

11. Xiao X, Wong RM. Vaccine hesitancy and perceived behavioral control: a meta-analysis. *Vaccine.* 2020;38(33):5131–5138. Doi:10.1016/j.vaccine.2020.04.076 [pubmed] [crossref] [Google Scholar]

12. Gidengil CA, Parker AM, Zikmund-Fisher BJ. Trends in risk perceptions and vaccination intentions: a longitudinal study of the first year of the H1N1 pandemic. *Am J Public Health.* 2012;102(4):672–679. Doi:10.2105/AJPH.2011.300407 [PMC free article] [pubmed] [crossref] [Google Scholar]

13. MacdonaldNE, Dubé E. Unpacking vaccine hesitancy among healthcare providers. Ebiomedicine2015;2:792-3.

14. Leask J, Willaby HW, Kaufman J. The big picture in addressing vaccine hesitancy. Hum VaccinImmunother 2014;10:2600-2.

15. Wallen J (2021) Medical students to be sent to COVID-19frontlines as India's hospitals face collapse. The Telegraph [newspaper on the Internet]. 2021 May 4 [cited 2021 May 18]; Available at https://www.telegraph.co.uk/\global-health/science-and-disease/medical-students sent-Covid 19-frontlinesindias- hospitals-face/

16. Saied SM, Saied EM, Kabbash IA, Abdo SAE. Vaccine hesitancy: Beliefs and barriers associated with COVID-19 vaccination among Egyptian medical students. J Med Virol. 2021 Jul;93(7):4280-4291. doi: 10.1002/jmv.26910. Epub 2021 Mar 25. PMID: 33644891; PMCID: PMC8013865.

17. Lucia VC, Kelekar A, Afonso NM. COVID 19-19 vaccine hesitancy among medical students. J Public Health (Oxf). 2020 Dec 26:fdaa230. Doi: 10.1093/pubmed/fdaa230. Epub ahead of print. PMID: 33367857; PMCID: PMC7799040

18. Qiao S et al. (2020) Vaccine acceptance among college students in south Carolina: do information sources and trust in information make a difference? Medrxiv[Preprint]. 2020 Dec 4: 2020.12.02.20242982. Doi:10.1101/2020.12.02.20 242982.

19. Fu C, Wei Z, Pei S, Li S, Sun X, Liu P. Acceptance and preference for COVID 19-19 vaccination in health-care workers (hcws). *Medrxiv.* 2020. Doi: https://doi.org/10.1101/2020.04.09.20060103. [Google Scholar]

20. Jain J, Saurabh S, Kumar P, Verma MK, Goel AD, Gupta MK, Bhardwaj P, Raghav PR. COVID 19-19 vaccine hesitancy among medical students in India. Epidemiology and Infection. 2021 May 20;149:e132. Doi: 10.1017/S0950268821001205. PMID: 34011421; PMCID: PMC8185413.

21. Afonso NM, Kavanagh MJ, Swanberg SM, Schulte JM, Wunderlich T, Lucia VC. Will they lead by example? Assessment of vaccination rates and attitudes to human papilloma virus in millennial medical students. BMC Public Health. 2017 Jan 6;17(1):35. doi: 10.1186/s12889-016-3969-x. PMID: 28056900; PMCID: PMC5217643

22. .Kernéis S et al. (2017) Vaccine education of medical students: a nationwide cross-sectional survey. American Journal of Preventive Medicine 53, e97–e104.

23. Shaw J, Stewart T, Anderson KB, Hanley S, Thomas SJ, Salmon DA, Morley C. Assessment of U.S. health care personnel (HCP) attitudes towards COVID-19 vaccination in a large university health care system. Clinical Infectious Disease. 2021 Jan 25:ciab054. doi: 10.1093/cid/ciab054. Epub ahead of print. PMID: 33491049; PMCID: PMC7929026.

24. Qattan AMN, Alshareef N, Alsharqi O, Al Rahahleh N, Chirwa GC and Al-Hanawi MK (2021) Acceptability of a COVID-19 Vaccine Among Healthcare Workers in the Kingdom of Saudi Arabia. *Front. Med.* 8:644300. doi: 10.3389/fmed.2021.644300

25. Martin Wiredu Agyekum, Grace Frempong Afrifa-Anane, Frank Kyei-Arthur, Bright Addo, "Acceptability of COVID-19 Vaccination among Health Care Workers in Ghana", *Advances in Public Health*, vol. 2021, Article ID 9998176, 8 pages, 2021. https://doi.org/10.1155/2021/9998176

26. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, Banza Ndala DB, Mbidi Miema J, Luhata Lungoyo C, et al Acceptability of Vaccination Against COVID-19 Among Healthcare Workers in the Democratic Republic of the Congo. Pragmat Obs Res. 2020 Oct 29;11:103-109. doi: 10.2147/POR.S271096. PMID: 33154695; PMCID: PMC7605960.

27. Wang K, Wong ELY, Ho KF et al., "Intention of nurses to accept coronavirus disease 2019 vaccination and change of intention to accept seasonal influenza vaccination during the coronavirus disease 2019 pandemic: a cross-sectional survey," *Vaccine*, vol. 38, no. 45, pp. 7049–7056, 2020.)

28. Verger P, Scronias D, Dauby N et al., "Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020," *Eurosurveillance*, vol. 26, no. 3, p. 2002047, 2021.

29. Macdonald NE, Butler R, Dub´e E. Addressing barriers to vaccine acceptance: an overview. *Hum Vaccines Immunother*. 2018;14(1):218–224. Https://doi.org/ 10.1080/21645515.2017.1394533.

30. Chu H, Liu S. Integrating health behavior theories to predict American's intention to receive a COVID 19-19 vaccine. *Patient Educ Counsel*. 2021 Feb 17. Https://doi.org/ 10.1016/j.pec.2021.02.031

31. Le TT, Cramer JP, Chen R, Mayhew S. Evolution of the COVID 19-19 vaccine development landscape. Nat Rev Drug Discov 2020;19:667-8

32. Lewandowsky S, Ecker UKH, Seifert CM, Schwarz N, Cook J. Misinformation and its correction: continued influence and successful debiasing. PsycholSci Public Interest. 2012;13:106–31.doi:10.1177/1529100612451018

33. Brunson EK. The impact of social networks on parents' vaccination decisions. Pediatrics. 2013;131(5):e1397– 404. doi:10.1542/peds.2012-2452.

34. Bish A, Yardley L, Nicoll A, Michie S. Factors associated with uptake of vaccination against pandemicinfluenza: a systematic review. Vaccine. 2011;29(38):6472–84. doi:10.1016/j. vaccine.2011.06.107