

Original Article

Uptake of Coronavirus Disease-2019 Vaccine Among Healthcare Workers in A Tertiary Hospital in Nigeria

Kwaghe VG^{1*}, Yalma R², Ojji O², Yahaya M³, Umoh V⁴, Ekele BA⁵

1. Department of Internal medicine, University of Abuja Teaching Hospital.
2. Department of Community medicine, University of Abuja Teaching Hospital.
3. Department of Nursing services, University of Abuja Teaching Hospital.
4. Department of medical health records, University of Abuja Teaching Hospital.
5. Department of Obstetrics and gynecology, University of Abuja Teaching Hospital.

*Corresponding author: viarra@yahoo.com

Received: 07 Mar 2022, Revised: 11 Apr 2022, Accepted: 05 May 2022, Published: 27 Dec 2022

How to cite this article: Kwaghe VG, Yalma R, Ojji O, et al. Uptake of Coronavirus Disease-2019 Vaccine Among Healthcare Workers in A Tertiary Hospital in Nigeria. J Nig Infect Dis Soc 2022;1(2):69–75. DOI: <https://doi.org/10.58539/JNIDS.2022.1211>

ABSTRACT

Introduction: Vaccines against the SARS-CoV-2 virus have been developed to curb the spread of the coronavirus disease 2019 (COVID-19). Healthcare workers (HCWs) have an increased risk of contracting and transmitting COVID-19. In addition, they also have a powerful influence on patient vaccination decisions. Earlier surveys had reported the willingness of HCWs to receive the vaccine; however, the actual uptake of the vaccine has rarely been reported. This study aimed at determining the actual uptake of the COVID-19 vaccine among healthcare workers in a tertiary hospital in Nigeria.

Methodology: The study was a cross sectional descriptive study that analyzed the data generated by the vaccination team that was mandated to administer the first batch of the COVID-19 vaccine to the HCWs at the University of Abuja Teaching Hospital (UATH).

Results: Out of 1718 HCWs, 387(22.5%) received the vaccine, 63.8% of whom were males. Vaccine uptake was highest among pharmacists (52.9%) and doctors (42.4); while uptake was lowest among the laboratory scientist (9.6 %) and the cleaners (9.8%). Vaccine uptake was higher among those with higher educational attainment compared to those with lower educational attainment.

Conclusions: The actual uptake of the COVID-19 vaccine among HCWs in Nigeria may be much lower than the potential uptake as reported in earlier surveys. The expression of willingness to take COVID-19 vaccine may be different from the actual acceptance of the vaccine. To understand the true magnitude of COVID-19 vaccine hesitancy among HCWs in Nigeria, we recommend that the actual uptake of the vaccine be evaluated.

Key words: COVID-19, vaccination, uptake, healthcare workers, Nigeria, vaccine hesitancy.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus-2 (SARS - CoV-2) was declared a global pandemic by the World Health Organization on the 11th of March 2020¹; since then more than 5.6 million people have died from the disease². Despite all the measures imposed by Governments globally to halt the spread of the disease such as wearing of face masks, travel bans, lockdowns, social distance, and frequent washing of hands, the death rates from COVID-19 continued to escalate.

It became apparent that vaccination would probably be the best preventive strategy to curb the spread of the disease and in May 2020, the 73rd World Health Assembly issued a resolution recognizing the role of extensive immunization as a global public -health goal for preventing, containing and stopping transmission of SARS-CoV-2³.

This led to a frantic effort globally to develop an effective vaccine against SARS-CoV-2. Less than a year later, some candidate vaccines were already approved for human use.

A vaccine is a biological preparation consisting of weakened, killed, or fragmented microorganisms or toxins or of antibodies or lymphocytes that is administered primarily to prevent disease⁴. A vaccine can confer active immunity against a specific harmful agent by stimulating the immune system to attack the agent. A vaccine may also confer passive immunity by providing antibodies or lymphocytes already made by an animal or human donor. When a person gets vaccinated against a disease, their risk of infection is reduced and they become less likely to transmit the virus or bacteria to others. As more people in a community get vaccinated, fewer people remain vulnerable as herd immunity is achieved.

The effectiveness of vaccination has been widely studied and verified. The English physician Edward Jenner in 1796 invented a vaccine against small pox and published evidence that it was effective⁵. Smallpox was a contagious and deadly disease that caused the deaths of 20–60% of infected adults and over 80% of infected children. With the help of the vaccine that was invented by Edward Jenner, small pox was eradicated in 1979⁶. Since then vaccines have been developed for infectious diseases such as mumps, measles, typhoid fever, cholera, plague, tuberculosis, tularemia, pneumococcal infection, tetanus, influenza, yellow fever, hepatitis A and hepatitis B. Vaccines have saved over 37 million lives, mostly children, over the past two decades⁷. The World Health Organization (WHO) reports that licensed vaccines are currently available for twenty -five different preventable infections⁸.

Despite the successes recorded by the use of vaccines, vaccine hesitancy remains a major challenge facing the industry. Vaccine hesitancy refers to delay in acceptance or refusal of vaccines despite availability of vaccine services⁹. Before the advent of COVID-19, vaccine hesitancy was already a global concern and has been shown to be influenced by factors such as complacency, convenience and confidence¹⁰. WHO has declared that vaccine hesitancy is a leading global health threat that poses a barrier to achievement of herd immunity¹¹. Some of the reasons for vaccine hesitancy include safety and efficacy concerns as well as distrust in government and health organizations. Trust in vaccines as well as the institutions that administer them is a key determinant of the success of any vaccination campaign.

Due to the inadequate supply of COVID-19 vaccines globally at the onset, governments prioritized high -risk groups to receive the initial supply of vaccines. In many countries around the world, healthcare workers (HCWs) were prioritized to receive the initial supply of the vaccines¹². In Nigeria, HCWs were prioritized to receive the initial supply of the ChAdOx1 nCoV-19 adenoviral (AZD 1222; Oxford - AstraZeneca) vaccine which was granted Emergency Use Authorization by the UK Medicines and Healthcare products Regulatory Agency on December 30, 2020¹³.

The WHO defines HCWs as all people engaged in actions whose primary intent is to enhance health. HCWs have an increased risk of contracting and transmitting COVID-19. Alasia et al reporting from Rivers state in Nigeria found a prevalence of 15.2% of COVID-19 infection among HCWs¹⁴. A similar report from Iran found a prevalence of 5.62%¹⁵; while a prevalence of 19.4% was reported among HCWs in New York City¹⁶. HCWs also have a potentially powerful influence on patient vaccination decisions¹⁷. Vaccinated HCWs are more likely to recommend vaccination to others; therefore, understanding and addressing HCWs vaccination attitudes is crucial to promoting COVID-19 vaccine acceptance.

Prior to the availability of the COVID-19 vaccines, several surveys were done in different countries across the globe to assess HCWs willingness to receive the vaccine. A study from Nigeria showed that 49.5% of the HCWs were willing to take the vaccine¹⁸; while a similar study in Ghana showed that 39.3% of the HCWs were willing to take the vaccine¹⁹. In Germany, Holzmann-Littig et al showed that 91.7% of HCWs in Germany were willing to receive the vaccine²⁰. We hypothesized that real-world uptake of the COVID-19 vaccine will be comparable with potential uptake as reported from these surveys. This study aimed at determining the actual uptake of the COVID-19 vaccine among healthcare workers in a tertiary hospital in Nigeria.

METHODOLOGY

STUDY SITE: The study was conducted at the University of Abuja Teaching Hospital (UATH), which is a tertiary health facility located in the Federal Capital Territory (FCT) in Nigeria. The hospital has a 520 -bed capacity and doubles as a training center for both the medical and nursing students as well as postgraduate fellowship training in various fields of Medicine. It is the biggest hospital in the North Central region of Nigeria and receives referrals from neighboring states. It has a staff strength of 1718, including doctors, Nurses, laboratory scientists, pharmacists, radiographers, physiotherapists, optometrists, dieticians, ward aids, cleaners, administrative and security personnel.

STUDY DESIGN: The study was a cross sectional descriptive study that analyzed the data generated by the vaccination team that was mandated to administer the COVID-19 vaccine to the hospital staff. All HCWs in UATH were eligible to receive the first batch of the ChAdOx1 nCoV-19 adenoviral (AZD 1222; Oxford - AstraZeneca) vaccine. As soon as the hospital was informed of the availability of the vaccine by the Federal Ministry of Health, a five- person committee was set up by the hospital management and given the mandate to conduct the vaccination exercise.

The committee prepared a vaccination schedule according to the different cadres of HCWs and the hospital management sent an internal memo to all the departments in the hospital informing them about the availability of the vaccine. The information and communication unit of the hospital was also engaged to disseminate the information to the entire hospital community. The vaccination exercise was conducted from the 15th of March 2021 to the 26th of June 2021. Using a questionnaire, data on demographic characteristics, professional cadre, previous COVID-19 infection, source of information on COVID-19 vaccine was obtained from the HCWs that were vaccinated. Vaccines were administered by trained vaccinators in accordance with the National Protocol. At the time of vaccination, the dose and batch number as well as the bio-data of the HCW were recorded and uploaded to the National Immunization and Vaccination System. All HCWs were observed for a minimum of 15 minutes post vaccination for any immediate adverse reaction. The HCWs that missed their scheduled vaccination day were attended to on any other day during the vaccination period. The primary outcome of interest was if a staff received the vaccine or not.

DATA ANALYSIS: Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0. Continuous variables were expressed as mean and standard deviation. Categorical variables were analyzed as counts and percentages.

ETHICAL APPROVAL: Data used for this study was based on secondary data analysis and ethical approval is not required. The UATH hospital management gave the approval for the release and use of the data which was de-identified to ensure anonymity.

RESULTS

At the end of the vaccination exercise, a total of 387 (22.5%) healthcare workers at the UATH received the AstraZeneca vaccine, 247 (63.8%) were males while 140 (36.2%) were females with a male to female ratio of 1.8:1. The mean age of those that received the vaccine was 38.6 years ($\pm$ 11.8 years). The majority of those vaccinated had postgraduate (42.1%) and bachelor's (40.5%) degrees; while those with secondary and primary school certificates constituted 11.5% and 0.7% respectively.

A total of 62 (16.0%) healthcare workers that were vaccinated reported a previous COVID-19 infection; 266 (68.7%) had no previous infection while 59 (15.2%) did not know whether they had been infected or not (table 1).

Table 1: socio-demographic characteristics of staff vaccinated

Socio-Demo	Frequency	Percent
GENDER		
male	247	63.8
female	140	36.3
Total	387	100
LEVEL OF EDUCATION		
primary	3	0.7
secondary	44	11.5
Bachelor's degree	157	40.5
Postgraduate degree	163	42.1
not stated	20	5.2
Total	387	100
PREVIOUS COVID-19 INFECTION		
YES	62	16.1
NO	266	68.8
I DON'T KNOW	59	15.2
Total	387	100

Vaccine uptake was highest among the pharmacists and the doctors. Out of 34 pharmacists in the hospital, 18 (52.9%) received the vaccine; while 171(42.4%) out of a total number of 403 doctors were vaccinated. Vaccine uptake was very low among the nurses (16.5%). The uptake was lowest among the staff of the accounts department (10.99%), the hospital cleaners (9.8%) and the laboratory scientists (9.6%) (Figure 1).

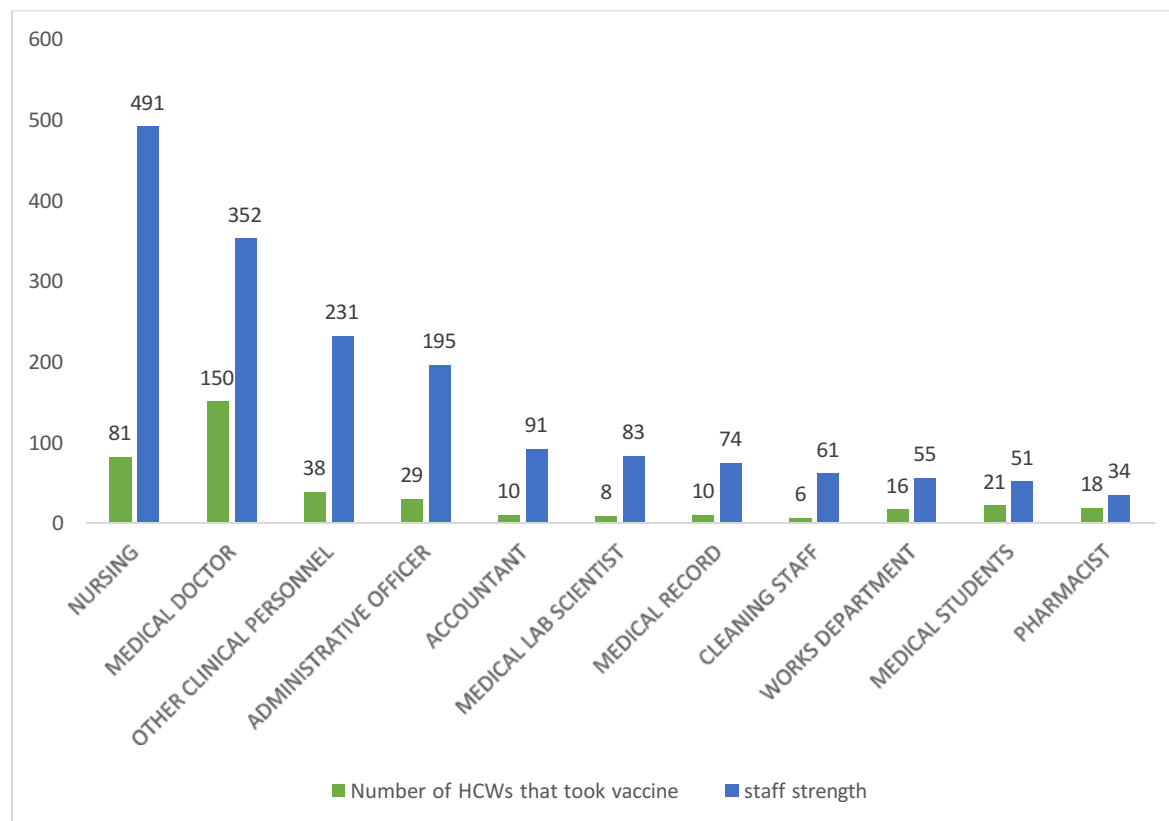


Fig. 1: COVID-19 vaccine uptake according to cadre of Healthcare worker

Information about the vaccine was accessed mainly from the television (330/387) and social media (252/387).

The newspaper (166/387) and radio (155/387) were the least source of information about the COVID-19 vaccine.

DISCUSSION

Prior to the availability of COVID-19 vaccines, several surveys conducted in different parts of the world reported the intention to receive COVID-19 vaccines among HCWs. In Nigeria, Robinson et al and Adejumo et al reported that 49.7 % and 53.5% respectively of HCWs were willing to take the vaccine if available^{21,22}. In the Kingdom of Saudi Arabia, 50.5% of the HCWs showed willingness to be vaccinated²³; while the rates ranged from 46 .9–63 .7% in USA^{24, 25}. Similar surveys in France and China showed rates of 76.6% and 79.1% respectively^{26, 27}.

However, the actual uptake of COVID-19 vaccination among HCWs has rarely been reported. This study looked at the actual proportion of HCWs that received the vaccine in a tertiary hospital in Nigeria . Out of the 1718 HCWs at UATH, only 387 actually received the vaccine, giving an overall uptake of 22.5%.

This report shows that the actual uptake of the vaccine among HCWs may be much lower than the potential uptake as reported in the earlier surveys . The expression of willingness to take COVID -19 vaccine may be different from the actual acceptance of the vaccine. The findings of this study confirm the fact that reported intentions may not always translate into vaccine uptake. Until we evaluate the actual uptake of the vaccine, we may not understand the magnitude of vaccine hesitancy among HCWs in Nigeria. The WHO regional report of 25th November 2021 stated that only 1 in 4 African HCW is fully vaccinated against COVID -19²⁸. The very poor uptake of the vaccine in Nigeria is in sharp contrast to reports from high income countries where more than 80% of the HCWs are fully vaccinated.

Xu et al reported that 86.2% of HCWs in perinatal medicine in China were already vaccinated against COVID-19 in the first three-month period of vaccination²⁹; while a report from Finland showed that about 90 % of the HCWs had received at least one dose of COVID-19 vaccine³⁰.

In this study vaccine uptake was higher among male HCWs compared to their female counterparts (63.8% vs 36.2%). Pre-vaccination surveys done in different parts of the world had shown that male HCWs were more willing to receive the vaccine compared to females^{19,23,31}. This could be explained by the fact that the risk perception of the disease has been shown to be higher among men compared to women³². In addition, some women have expressed the fear of infertility as a potential side effect of the vaccine, thereby preventing them from being vaccinated. Needle phobia which is commoner among females compared to males may also be a contributing factor³³.

Vaccine uptake was highest among pharmacists (52.9%) and doctors (42.6%). This finding confirms what some surveys had earlier reported that more doctors were willing to take the vaccine compared to Nurses. The survey on acceptability of COVID -19 vaccine among HCWs in Ghana showed that medical doctors were more likely to accept the COVID-19 vaccines than nurses and midwife (AOR = 2.851; 95 CI%: 1.097–7.405; $p = 0.031$)¹⁹. A similar finding was reported in the USA and France^{34,35}. In this study, vaccine uptake among the nurses was 16.5% compared to 42.6% among the doctors. The fact that majority of nurses are females may explain the lower uptake of the vaccine among nurses.

Educational attainment has been shown to be an important factor in determining whether an individual receives the vaccine or not^{36,37}. People with lower educational attainment may not read the recent research, and are more likely to believe in community myths and misconceptions. In this study, the majority of the HCWs that were vaccinated either had a bachelor's (40.5%) or a post graduate (42.1%) degree (Table 1); only 11.5% and 0.7% of those vaccinated had secondary and primary school certificates respectively as their highest level of educational attainment. This finding confirms the reports from earlier surveys in Nigeria and indeed other countries that had shown that the highly educated were more willing to receive the COVID-19 vaccine compared to the less educated^{18, 38, 39}. A survey in the USA showed that non-intent to receive the vaccine was higher among adults with lower educational attainment and lower income⁴⁰.

The main reasons most frequently given for non-willingness to receive the COVID-19 vaccine include concerns with side effects and safety of the vaccine⁴¹. Others have concerns that the vaccines were developed too quickly. In Nigeria, myths and misconceptions have shrouded the disease and the vaccine. While some believe the disease does not exist in the first place, others believe it was intentionally created in a laboratory as a weapon of bioterrorism targeted at reducing the population of the world. These conspiracy theories and fake news have all contributed to the low uptake of the vaccine.

Unfortunately, HCWs who have more medical knowledge and should be promoting the vaccine have also fallen victims of these myths and misconceptions about COVID -19 and COVID-19 vaccines.

This study has its limitations; it's cross sectional design prevents identification of causal factors. Secondly, we only examined the uptake of the first batch of the Oxford - AstraZeneca vaccine. Subsequently other vaccine candidates became available in the Country and some HCWs who did not receive the vaccine in the first batch may have received it subsequently. Thirdly, the study was a single centre study.

CONCLUSION

Though reports from several surveys had shown the potential uptake of the COVID-19 vaccine among HCWs, the actual uptake has been rarely reported. This study looked at the actual uptake of the vaccine by HCWs in a tertiary hospital and the result showed that among HCWs in Nigeria, the actual uptake may be much lower than the potential uptake. The fact that someone expresses willingness to take COVID -19 vaccine does not translate to the fact that they will eventually receive the vaccine if available. Therefore, to understand the true magnitude of COVID -19 vaccine hesitancy among HCWs in Nigeria, we recommend that the real-world actual uptake of the vaccine be evaluated. If stakeholders and policy makers do not address this menace among HCWs, the overall success of COVID-19 vaccination in the country may be in jeopardy.

COMPETING INTERESTS

The authors declare no competing interest.

ACKNOWLEDGEMENTS

We acknowledge the Chief Medical Director of UATH for his support and the management of UATH for their consent to release the data for this study.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

None

AUTHORS' CONTRIBUTION

Conceptualization: VGK, RY; Methodology: VGK, RY, MY, OJ, MY, VU, BAE; Investigation: VGK, RY, OJ, VU, MY; Analysis: RY, VGK; writing original draft: VGK; review and editing: VGK, RY, OJ, MY, VU, BAE.

REFERENCES

1. Cucinotta D, Vanelli M. WHO Declares COVID -19 a Pandemic. *Acta Biomed* 2020; 91(1):157-60.
2. <https://covid19.who.int/> (Accessed February 02, 2022).
3. World Health Organization. https://apps.who.int/gb/ebwha/pdf_files/WHA73/A73_R1-en.pdf (Accessed February 02, 2022)
4. <https://www.britannica.com/science/vaccine> (Accessed January 20, 2022).
5. Riedel S. Edward Jenner and the history of smallpox and vaccination. *Proc (Bayl Univ Med Cent)* 2005; 18(1):21-5.
6. Hopkins JW. The eradication of smallpox: organizational learning and innovation in international health administration. *J Dev Areas* 1988; 22(3):321-32.
7. <https://www.usnews.com/news/health-news/articles/2021-02-04/vaccines-saved-37-million-lives-mostly-children-over-past-two-decades> (Accessed January 20, 2022).
8. <https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases> (Accessed January 20, 2022).
9. MacDonald NE; SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015; 33(34):4161-4.
10. Machingaidze S, Wiysonge CS. Understanding COVID-19 vaccine hesitancy. *Nat Med* 2021; 27(8):1338-9.
11. World Health Organization (2019). Ten Threats to Global Health in 2019. Available at: <https://www.who.int/emergencies/ten-threats-to-global-health-in-2019> (Accessed January 24, 2022).
12. Dooling K, McClung N, Chamberland M, et al. The Advisory Committee on Immunization Practices' interim recommendation for allocating initial supplies of COVID-19 vaccine—United States, 2020. *MMWR Morb Mortal Wkly Rep.* 2020; 69:1857-9.
13. Voysey M, Clemens SAC, Madhi SA et al. Safety and efficacy of the ChAdOx 1 nCoV -19 vaccine (AZD 1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *Lancet* 2021; 397: 99–111.
14. Alasia DD, Maduka O. Prevalence and pattern of COVID -19 among healthcare workers in rivers State Nigeria. *Occup Dis Environ Med* 2021; 09(01): 20-32.
15. Sabetian G, Moghadami M, Hashemizadeh Fard Haghighi L et al. COVID -19 infection among healthcare workers: a cross-sectional study in southwest Iran. *Virol J* 2021; 18(1):58.
16. Stock AD, Bader ER, Cezayirli P et al. COVID-19 Infection among Healthcare Workers: Serological Findings Supporting Routine Testing. *Front Med (Lausanne)* 2020; 7 :471.
17. Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine* 2016; 34(52):6700-6.
18. Amuzie CI, Odini F, Kalu KU et al. COVID-19 vaccine hesitancy among healthcare workers and its socio-demographic determinants in Abia State, Southeastern Nigeria: a cross-sectional study. *Pan Afr Med J* 2021; 40:10 .
19. Agyekum M, Afrifa-Anane G, Kyei-Arthur F, Bright Addo. Acceptability of COVID-19 vaccination among health care workers in Ghana. *Advances in Public Health* 2021; <https://doi.org/10.1155/2021/9998176>.
20. Holzmann-Littig C, Braunisch M, Kranke P, et al. COVID-19 Vaccination acceptance and hesitancy among healthcare workers in Germany. *Vaccines* 2021; 9:777.
21. Robinson ED, Wilson P, Eleki BJ, Wonodi W. Knowledge, acceptance, and hesitancy of COVID-19 vaccine among health care workers in Nigeria. *MGM J. Med. Sci* 2021; 8:102–10.
22. Adejumo OA, Ogundele OA, Madubuko CR et al. Perceptions of the COVID-19 vaccine and willingness to receive vaccination among health workers in Nigeria. *Osong Public Health Res Perspect.* 2021; 12(4):236-43.
23. Qattan AMN, Alshareef N, Alsharqi O, Al Rahahleh N, Chirwa GC, Al-Hanawi MK. Acceptability of a COVID-19 vaccine among healthcare workers in the Kingdom of Saudi Arabia. *Front. Med* 2021; 8:644300.
24. Gadoth M.A., Halbrook M.M., Martin-Blais R et al. Cross-sectional Assessment of COVID-19 Vaccine Acceptance among Health Care Workers in Los Angeles. *Ann. Intern. Med.* 2021; 174:882–5.
25. Kuter B.J., Browne S., Momplaisir F.M et al. Perspectives on the receipt of a COVID-19 vaccine: A survey of employees in two large hospitals in Philadelphia. *Vaccine.* 2021; 39:1693–700.
26. Gagneux-Brunon A., Detoc M., Bruel S et al. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: A cross-sectional survey. *J. Hosp. Infect.* 2021; 108:168–173.
27. Wang J., Feng Y., Hou Z et al. Willingness to receive SARS-CoV-2 vaccine among healthcare workers in public institutions of Zhejiang Province, China. *Hum. Vaccines Immunother.* 2021:1–8. doi: 10.1080/21645515.2021.1909328.

28. <https://www.afro.who.int/news/only-1-4-african-health-workers-fully-vaccinated-against-covid-19> (Accessed January 24, 2022).
29. Xu B, Gao X, Zhang X, Hu Y, Yang H, Zhou YH. Real-World Acceptance of COVID -19 Vaccines among Healthcare Workers in Perinatal Medicine in China. *Vaccines (Basel)* 2021; 9(7):704.
30. Poukka E, Baum U, Palmu AA et al. Cohort study of Covid-19 vaccine effectiveness among healthcare workers in Finland, December 2020 - October 2021. *Vaccine* 2021; S 0264-410X (21)01640-6.
31. Biswas N, Mustapha T, Khubchandani J, Price JH. The Nature and Extent of COVID -19 Vaccination Hesitancy in Healthcare Workers. *J Community Health* 2021; 46(6):1244-51.
32. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G et al. Acceptability of Vaccination Against COVID -19 Among Healthcare Workers in the Democratic Republic of the Congo. *Pragmat Obs Res* 2020; 11:103-9.
33. McLendon J, Rogers MAM. The fear of needles: A systematic review and meta-analysis. *J Adv Nurs*. 2019; 75(1):30-42.
34. Shaw J, Stewart T, Anderson KB et al. Assessment of US health care personnel (HCP) attitudes towards COVID-19 vaccination in a large University health care system. *Clinical Infectious Diseases* 2021; 73(10):1776-83.
35. 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. *Euro Surveill* 2021; 26(3):2002047.
36. Pacella -LaBarbara ML, Park YL, Patterson PD et al. COVID -19 Vaccine Uptake and Intent among Emergency Healthcare Workers: A Cross -Sectional Survey. *J Occup Environ Med*. 2021; 63(10):852-6.
37. Al-Sanafi M, Sallam M. Psychological Determinants of COVID-19 Vaccine Acceptance among Healthcare Workers in Kuwait: A Cross -Sectional Study Using the 5C and Vaccine Conspiracy Beliefs Scales. *Vaccines (Basel)* 2021; 9(7):701.
38. Humer E, Jesser A, Plener PL, Probst T, Pieh C. Education level and COVID -19 vaccination willingness in adolescents. *Eur Child Adolesc Psychiatry* 2021; 1–3.
39. Handebo S, Wolde M, Shitu K, Kassie A. Determinant of intention to receive COVID -19 vaccine among school teachers in Gondar City, Northwest Ethiopia. *PLoS One*. 2021; 16(6): e0253499.
40. 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):964-73.
41. Dhama K, Sharun K, Tiwari R et al. COVID-19 vaccine hesitancy - reasons and solutions to achieve a successful global vaccination campaign to tackle the ongoing pandemic. *Hum Vaccin Immunother*. 2021; 17(10):3495-9.