Determinants of COVID-19 vaccine acceptance and hesitancy among healthcare professionals in the Kintampo North Municipality, Bono East Region, Ghana

Mubarick N. Asumah 1,2, Abdulai Abubakari 1, Brian Fosu 2, Edem K. Dzantor 3, Prince D. Agyapong 4, Samuel B.E. Harrison 4, Gavin Apio 5 and Abdul-Kahar Abukari 5

Ghana Med J 2022; 56(3): 152-159 doi: http://dx.doi.org/10.4314/gmj.v56i3.4

1Department of Global and International Health, School of Public Health, University for Development Studies, P.O. Box TL1350, Tamale Northern Region, Ghana.
2Ghana Health Service, Kintampo Municipal Hospital, P.O. Box 192, Kintampo Bono East, Ghana.
3Department of Epidemiology and Biostatistics, School of Public Health, University for Development Studies, P.O. Box TL1350, Tamale Northern Region, Ghana.
4Kintampo Health Research Centre, Research and Development Division, Ghana Health Service P.O. Box 200, Kintampo, Bono East Region, Ghana.
5Academic and Student’s Affairs Department, University for Development Studies, P.O. Box TL1350, Tamale Northern Region, Ghana.

Corresponding author: Mubarick N. Asumah
E-mail: nunghaso.asumah@uds.edu.gh
Conflict of interest: None declared

SUMMARY

Objectives: To assess the determinants of COVID-19 vaccine acceptance and hesitation among Health Care Professionals (HCPs) in the Kintampo North Municipality of Ghana.

Design: An analytical cross-sectional study.

Setting: The study was carried out in the Kintampo North Municipality.

Participants: All health care professionals within the Kintampo North Municipality of Ghana.

Main outcome measure: Acceptance of COVID-19 vaccine.

Results: In all, 215 HCPs were included in this study. The overall vaccine acceptance was 78.6% among HCPs, while 21.4% were hesitant to receive the COVID-19 vaccine. Majority (57.7%) of HCPs believed that COVID-19 vaccines were safe. The following factors were found to influence vaccine acceptance significantly: those who knew someone who has taken the vaccine (adjusted Odds Ratio [aOR]; 14.9, 95% Confidence Interval [95% CI]; 5.0-45.0, p<0.001), those who think COVID-19 vaccine in Ghana was safe (aOR;9.2, 95%CI;3.3-25.8, P<0.001), those who said vaccines are effective in controlling COVID-19 transmission (aOR;5.0, 95%CI;2.1-12.4, p<0.001), and those who are not hesitant to take COVID-19 vaccinations (aOR;=7.4, 95%CI;1.6-37.8, P=0.01).

Conclusion: The study indicated high COVID-19 vaccination acceptability among HCPs. However, some HCPs are hesitant to take COVID-19 vaccinations immediately. Increased adoption of COVID-19 vaccinations among HCPs and the broader Ghanaian population requires concerted efforts, including strengthening public health education on the perceived risks and safety of COVID-19 vaccines.

Keywords: Acceptance, COVID-19, healthcare professionals, hesitancy, vaccine

Funding: None declared

INTRODUCTION

In March 2020, the Coronavirus Disease 2019 (COVID-19) was declared a pandemic, and it has since become a serious public health hazard worldwide.1 Following the emergence of COVID-19 disease, some safety protocols such as fumigation of all public places, social and physical distancing strategies, the mandatory wearing of masks in public spaces, and in extreme instances, total or partial lockdown are being implemented in many countries.2 Despite all these strategies, currently, some countries are hit by the third wave of the virus. Worldwide, 187,519,798 persons have contracted COVID-19, with 4,049,372 deaths as of July 14, 2021, with 3,400,884,367 persons so far vaccinated against the COVID-19 disease.3

In Ghana, by 15th May 2021, 93,456 cases had been detected with 771 deaths which included health care professionals (HCPs).4 Although adhering to COVID-19 safety protocols are essential to containing the virus5,6, vaccines are one of the most effective strategies for halting and preventing viral transmission.7,8 By the second month of 2021, over seventy vaccines were at various stages of development,
with approximately twenty of these vaccines in phase III clinical trials. While most vaccines are progressing steadily, others have been approved and are currently being used in many countries. Some vaccinations are now approved for human use and are deemed safe and effective, including AstraZeneca, Pfizer, Janssen, Johnson and Johnson, Sputnik V, Moderna, Sinovac, and Sinopharm. In Ghana, efforts are being made to procure more Oxford/AstraZeneca vaccines to vaccinate the citizenry. As of May 7, 2021, eight hundred and fifty-two thousand and forty-seven (852,047) AstraZeneca vaccine doses had been administered in Ghana. Frontline healthcare professionals have been recognised among those who received the vaccine.

Despite the overwhelming evidence on the beneficial impact of vaccines on health outcomes, vaccine hesitination among individuals and communities still exists. Vaccine hesitancy refers to a person’s unwillingness, delay in accepting, or refusal to receive immunisations despite vaccine delivery services being available. It is a complex dynamic interplay of factors that vary across persons, time, location, and vaccinations and is heavily influenced by complacency, convenience, and confidence. Vaccine hesitancy has become a global challenge, with vaccine hesitination increasing steadily, while only 37% of countries are undertaking assessments of vaccine hesitancy. The World Health Organization (WHO) has emphasised that vaccine hesitancy was among the top ten global health threats in 2019. Currently, some health care professionals and the general Ghanaian population have been very sceptical about accepting to take the COVID-19 vaccine. In many low- and middle-income countries, including Ghana, there is insufficient research on the causes of vaccine hesitancy. A study on COVID-19 vaccine acceptance in Ghana found that 39.2 per cent of respondents were willing to accept the COVID-19 vaccine. Research on COVID-19 vaccine hesitancy among Ghanaian health professionals remains limited.

The fact that COVID-19 vaccinations are available does not imply that they will be accepted or used. Available literature has shown that the acceptance of the COVID-19 vaccine varies and depends on various factors such as public confidence in the COVID-19 vaccine, literacy or educational level of individuals, ethnic beliefs, myths and misconceptions about the vaccine and/or the virus. COVID-19 vaccination acceptability was higher among research participants in 19 nations, according to a survey. However, available research shows that not all health professionals are willing to take the COVID-19 vaccine, even if the vaccines were made available. For instance, in the USA, only 36.0% in Japan, 62.1% and in the Democratic Republic of Congo, only 28% of health care professionals were prepared to receive the COVID-19 vaccine. Concerns about vaccination safety, side effects, and the speed with which COVID-19 vaccines are developed and approved have been mentioned as reasons for reluctance to accept COVID-19 vaccines.

Healthcare professionals are trustworthy information sources for patients. The attitude of HCP toward COVID-19 vaccines is an important factor in COVID-19 vaccine uptake among the general public. Understanding the factors underlying HCPs vaccination acceptance and refusal rates has implications for future vaccine programs for the Ghanaian population and other developing countries. It is important to conduct multiple studies on the COVID-19 vaccine in multiple settings, from which a baseline targeted intervention can be developed. The current study assessed COVID-19 vaccine acceptability among healthcare professionals (HCP) in Kintampo North Municipal, Ghana.

METHODS
Study setting
The research was carried out at the Kintampo Municipal Hospital at Kintampo North Municipal. “The Municipality is strategically positioned in the heart of Ghana, between latitudes 8°45’N and 7°45’N, and longitudes 1°20’W and 2°1’E, and acts as a transit point between the northern and southern parts of the nation”. The projected population of the municipality based on the 2010 population and housing census is 118,965 people, with 58,935 (49.5%) being males and 60,030 (50.5%) being females.

Study design
In this research, an analytical cross-sectional study design was used. The study design employed the quantitative approach to obtain information from participants.

Study population
The study population comprises all healthcare professionals within the Kintampo North Municipality of Ghana.

Sampling and sample size determination
The study’s sample size was estimated using the Survey Monkey Sample Size Calculator. The estimated population of health professionals in Kintampo North Municipal was 736 as of January 2021. Using a confidence level of 95% and a 5% margin of error, the sample size was estimated to be 253 health professionals. The list of all 736 healthcare professionals was obtained from the Kintampo North Municipal Health Directorate. Using Microsoft Excel random numbers, the list was randomised and used for simple random selection.
of the target sample. The first 253 on the list were then recruited into the study without replacement.

Data collection techniques and tools
The data was collected using a standardised self-administered questionnaire. The questionnaire was derived from some previously published studies\(^\text{29,30,38}\) and modified. The survey was divided into three parts (Sections A, B, and C). Items on sociodemographic variables are found in Section A, perceptions of the COVID-19 pandemic and vaccines are found in Section B, and acceptability, hesitation, and determinants of COVID-19 vaccination are found in Section C.

The contacts of healthcare professionals in the municipality were collected from the Municipal Health Directorate (MHD). They were randomly contacted by phone to determine their willingness to participate in the study. Following consent, an electronic link was provided to health personnel through email and WhatsApp to complete the questionnaire. The electronic questionnaire was structured so that the same device (mobile phone or computer) could not submit the questionnaire twice, ensuring that such persons did not attempt the quiz more than once. Secondly, health professionals who do not have a WhatsApp number were contacted directly via phone to complete the questionnaire items. Those who consented to participate in the research and requested a hard copy questionnaire were printed and delivered to them to fill out and return in a sealed envelope. The data collection lasted 10 weeks, from January 2021 to March 2021.

Data Analysis and Presentation of Results
Out of the 253 questionnaires distributed, 239 respondents returned filled questionnaires, representing a 94.0% response rate. However, after all questionnaires were audited for their completeness and signing of the consent form, 215 questionnaires were considered for analysis.

The Statistical Package for Social sciences (SPSS) software version 25 was used to code and analyse the data. The results were presented in tables. Chi-square analysis was utilised to compare categorical variables, and a p-value of 0.05 was considered statistically significant. To determine the factors impacting COVID-19 vaccination uptake, a chi-square analysis was done. A binary logistic regression model included all variables with P values of ≤ 0.25 in the chi-square analysis. The benchmark P value of ≤0.25 was selected because of its closeness to zero (0), thus enabling the inclusion of all potentially relevant predictive variables in the adjusted model. The fully adjusted model was fitted to assess how each independent variable affected the dependent variable.

Ethical considerations
The Committee on Human Research Publications & Ethics, Kwame Nkrumah University of Science and Technology (KNUST) - Komfo Anokye Teaching Hospital (KATH), Ghana, gave clearance for this study with the reference ID: CHRPE/AP/225/21. Before being included in the study, each subject gave verbal and written consent. Subjects who refused to consent were not allowed to participate in the study.

RESULTS
Socio-demographic Characteristics
With a mean age of 30.9 years and a standard deviation of 5.6, most respondents were in their 30s or older. Males formed the majority (56.3%) of respondents, while 40.9% of the respondents had a university first degree as the highest level of education. The majority (50.2%) of the HCP were married, 62.8% were Christians, and a higher proportion (40.5%) earned above GHS 2,000.00 (350 USD) as an average monthly income (Table 1).

| Variables                  | Category          | Number (%) |
|----------------------------|-------------------|------------|
| Age                        | Less than 30 years| 102 (47.4) |
|                            | 30 years and above| 113 (52.6) |
| Mean±SD                    |                   | 30.9±5.6   |
| Gender                     | Male              | 121 (56.3) |
|                            | Female            | 94 (43.7)  |
| Highest level of education | Certificate       | 44 (20.5)  |
|                            | Diploma           | 54 (25.1)  |
|                            | Degree            | 88 (40.9)  |
|                            | Masters           | 29 (13.5)  |
| Marital Status             | Single            | 103 (47.9) |
|                            | Married           | 108 (50.2) |
|                            | Widowed/divorced  | 4 (1.9)    |
| Religion                   | Christian         | 135 (62.8) |
|                            | Muslim            | 80 (37.2)  |
| Average Monthly Income     | Less than 1000    | 47 (21.9)  |
|                            | Between 1000-2000 | 81 (37.7)  |
|                            | Over 2000         | 87 (40.5)  |

COVID-19 Perception, impact, and Vaccine intake history
Almost all respondents (96.7%) believed they had good health, and 98.6% believed COVID-19 cases were present in Ghana. More than half (54.9%) of the respondents believe that the risk of COVID-19 was low. The majority (86.5%, 90.2%, and 67.4%) of the study participants said COVID-19 impacts daily life, work, and income, respectively. Over 76% of the respondents knew someone who has taken the COVID-19 vaccine in Ghana and other
countries, 45.1% had taken the influenza vaccine in the past, 30.2% knew the efficacy of the COVID-19 vaccine in Ghana, 7% had refused uptake of vaccines in the past, and the majority (57.7%) of respondents thought the COVID-19 vaccines in Ghana were safe (See Table 2 for details).

Table 2 COVID-19 perception, impact and vaccine intake history (N=215)

| Variables                           | Category      | Number (%) |
|-------------------------------------|---------------|------------|
| How do you see your health?         |               |            |
|                                     | Good Health   | 208 (96.7) |
|                                     | Poor Health   | 7 (3.3)    |
| COVID-19 cases confirmed in Ghana   |               |            |
|                                     | Yes           | 212 (98.6) |
|                                     | No            | 3 (1.4)    |
| Perceived Risk of COVID-19          |               |            |
|                                     | High          | 97 (45.1)  |
|                                     | Low           | 118 (54.9) |
| COVID-19 impacts daily lives        |               |            |
|                                     | Yes           | 186 (86.5) |
|                                     | No            | 29 (13.5)  |
| COVID-19 impacts work               |               |            |
|                                     | Yes           | 194 (90.2) |
|                                     | No            | 21 (9.8)   |
| COVID-19 impacts income             |               |            |
|                                     | Yes           | 145 (67.4) |
|                                     | No            | 70 (32.6)  |
| Know someone who has taken the COVI D-19 vaccine | Yes | 164 (76.3) |
|                                     | No            | 51 (23.7)  |
| Have taken vaccine in the past       |               |            |
|                                     | Yes           | 97 (45.1)  |
|                                     | No            | 71 (33.0)  |
|                                     | Not Sure      | 47 (21.9)  |
| Have refused vaccine in the past     |               |            |
|                                     | Yes           | 15 (7.0)   |
|                                     | No            | 200 (93.0) |
| COVID-19 vaccine is safe             |               |            |
|                                     | Yes           | 124 (57.7) |
|                                     | No            | 91 (42.3)  |
| Knew efficacy of the COVID-19 vaccine in Ghana | Yes | 65 (30.2)  |
|                                     | No            | 150 (69.8) |

COVID-19 vaccine acceptance and preferences

Only 11.2% believed that vaccines alone could prevent COVID-19, while 68.4% believed that vaccines in general, were effective in preventing COVID-19.

The COVID-19 vaccine acceptance rate was 78.6% among HCPs, while 21.4% were hesitant to receive the vaccine. The findings of this study further revealed that 53.0% needed a medical officer’s advice before they would take the vaccine, and 47.4% believed that vaccine convenience (i.e., place of vaccination, distance to the vaccine site, cost of the vaccine, etc.) would influence their decision to accept the COVID-19 vaccine. A little over half (51.2%) would be willing to take the vaccine as soon as it becomes available, while 48.8% opined that they would delay receiving the vaccine to monitor its safety among those who have taken it. Most (63.3%) did not prefer the origin of the vaccine (i.e., they were willing to take both imported and domestic). (Table 3)

Table 3 COVID-19 vaccine acceptance and preferences (N=215)

| Variables                           | Category      | Number (%) |
|-------------------------------------|---------------|------------|
| Would Vaccines alone prevent COVID-19 | Yes           | 24 (11.2)  |
|                                     | No            | 191 (88.8) |
| Vaccine effective in Preventing COVID-19 | Yes           | 147 (68.4) |
|                                     | No            | 68 (31.6)  |
| Willingness to accept vaccine        |               |            |
|                                     | Yes           | 169 (78.6) |
|                                     | No            | 46 (21.4)  |
| Needs doctor’s advice to take vaccine | Yes           | 114 (53.0) |
|                                     | No            | 101 (47.0) |
| Convenience influence vaccine acceptance | Yes           | 102 (47.4) |
|                                     | No            | 113 (52.6) |
| Readiness to take vaccine if available | As soon as possible | 110 (51.2) |
|                                     | Delay, until confirmation of the safety of the vaccine | 105 (48.8) |
| Vaccine preference                   |               |            |
|                                     | Imported      | 38 (17.7)  |
|                                     | Domestic      | 41 (19.1)  |
|                                     | Both          | 136 (63.3) |

Factors affecting the COVID-19 vaccine uptake

Table 4 shows factors affecting the acceptance of the COVID-19 vaccine. The study revealed that health professionals aged 30 and older were 2.2 times more likely to accept the COVID-19 vaccine (aOR=2.2, 95 per cent CI; 0.9-5.4, p=0.09). Also, respondents who knew someone who had received the COVID-19 vaccine were 14.9 times more likely to accept the COVID-19 vaccine (aOR=14.9, 95 per cent CI; 5.0-45.0, p=0.001). Respondents who had never refused any vaccines in the past were 5.4 times more likely to accept COVID-19 vaccines. Health professionals who believe vaccines are effective in preventing COVID-19 transmission are 5.0 times more likely to accept the COVID-19 vaccine (aOR=5.0, 95 per cent CI; 2.1-12.4, p<0.001).

Respondents who believed they were at high risk of COVID-19 were 1.8 times more likely to accept the COVID-19 vaccine (aOR=2.3, 95 per cent CI; 0.7-4.6, p=0.2).

Table 4 Factors affecting the COVID-19 vaccine uptake

| Factors                           | Measures | aOR   | 95% Confidence Interval (CI) |
|-----------------------------------|----------|-------|-------------------------------|
| Age                               | <30 years| Ref<sup>*</sup> |                             |
|                                  | ≥30 years| 2.2   | 0.9                           |
|                                   |          |       | 5.4                           |
|                                   |          |       | 0.09                          |
| Knew someone who has taken the COVI D-19 vaccine | No | Ref<sup>*</sup> |                   |
|                                   | Yes      | 4.9   | 5.0                           |
|                                   |          |       | 45.0                          |
|                                   |          |       | <0.001                        |

www.ghanamedj.org Volume 56 Number 3 September 2022

Copyright © The Author(s). This is an Open Access article under the CC BY license.
DISCUSSION

There exists a consensus among several researchers indicating the effectiveness of the COVID-19 vaccine against the spread of infection through the attainment of herd immunity. Nonetheless, the tendency to refuse the COVID-19 vaccine by the public has become an issue of global importance. Previous studies conducted elsewhere have given the varying acceptance of the COVID-19 vaccine.

Most of the respondents indicated they were in good health. Respondents equally indicated that COVID-19 was present in Ghana but thought that they stood at a lower risk of getting infected. The respondents’ perception of their health status and risk may not affect their readiness to accept the COVID-19 vaccine. The acceptance rate of the COVID-19 vaccine found in the present study was higher than reported by Agyekum et al., Fakonti et al., Adeniyi et al., and Kwok et al. Among HCPs, the acceptance rate was higher by Adeniyi et al. and Kwok et al. However, the acceptance rate was lower by Fakonti et al. and Agyekum et al. The findings above are very much inconsistent with the findings of the present study.

Factors including age 30+ years, knowledge of someone who had taken the vaccine, those who had never refused a vaccine previously, the safety of the COVID-19 vaccine, the effectiveness of the vaccine in controlling COVID-19 transmission, and perceived higher risk of COVID-19 were good predictors of COVID-19 vaccine acceptance among respondents in our study. Elhadi et al. reported higher odds of COVID-19 vaccine intake among persons aged 30+ years. Similarly, Fakonti et al. and Mesele reported higher odds of accepting the COVID-19 vaccine among HCPs and individuals who have received vaccines in the past. Reiter et al. found perceived higher risk and effectiveness as good indicators for COVID-19 vaccine acceptance among HCPs.

The observed predictors in our study and others elsewhere could be used to draw baseline targeted interventions and public health educational programmes. For example, individuals who have been previously vaccinated can be targeted among HCPs and at the community or population level to be vaccinated and used as educators to influence others to get vaccinated against COVID-19.

Again, as explained in some health behaviour change models, including the health belief model (HBM), per-
ceived risk and severity have the tendency to cause individuals to adopt good health-seeking behaviours. The perceived risk as a good predictor for COVID-19 vaccine intake identified in our study could be used as a trump card to educate HCPs as well as the public on the threat including the severity of COVID-19 and hence the need to get vaccinated. Similarly, highlighting the safety of the vaccine could help increase vaccine confidence and acceptance among HCPs and the public.

Limitations
Our study is a cross-sectional survey, representing a snapshot of HCPs’ readiness to accept or not to accept the COVID-19 vaccine within the study’s time frame stressing that the responses of the respondents are subject to change depending on factors, including additional vaccine safety data. Therefore, relying on the findings solely should be done with caution. The 215 participants studied, as opposed to the 253, which was the estimated minimum sample required for the study, could affect both the internal and external validity of the study. However, the evidence available shows that for a survey to be representative of the sample population, a response rate of ≥ 80% is expected.6 The target response rate of 70% is considered the minimum for the generalisation of a survey.54 The response rate in this study was 94.0% as such, both the internal and external validity could not be compromised. Importantly, acknowledging similar findings elsewhere among recently published research supports our study in designing targeted public health interventions.

CONCLUSION
This study indicated high COVID-19 vaccination acceptability among HCPs. However, some HCPs are hesitant to take COVID-19 vaccinations immediately. Factors such as knowing someone who had received the vaccine, acceptance of vaccines in the past, and safety and effectiveness of the COVID-19 vaccine determined vaccine acceptance. Increasing acceptance of COVID-19 vaccinations among HCPs and the Ghanaian population, in general, requires concerted efforts. This could be done by strengthening public health education on the perceived risks and safety of COVID-19 vaccines.

REFERENCES
1. Organisation WH. World Health Organization coronavirus disease (COVID-19) dashboard. 2020;
2. Farsalinos K, Poulas K, Kouretas D, Vantarakis A, Leotsinidis M, Kouvelas D, et al. Improved strategies to counter the COVID-19 pandemic: Lockdowns vs. primary and community healthcare. Toxicol Reports. 2021;8:1–9.
3. WHO. coronavirus disease (COVID-19) dashboard. WHO. 2021. 2021.
4. Ministry of Information. Ministry of Information press briefing: “Second dose of Covid Vaccination Program” [Internet]. Ghana: Facebook; Available from: https://web.facebook.com/moi.gov.gh/videos/second-dose-of-covid-vaccination-program/749015055718537/?_rdr=1&_rdr
5. Humphreys J. The importance of wearing masks in curtailing the COVID-19 pandemic. J Fam Med Prim Care. 2020;9(6):2606.
6. Perencevich EN, Diekema DJ, Edmond MB. Moving personal protective equipment into the community: face shields and containment of COVID-19. Jama. 2020;323(22):2252–3.
7. Qualls N, Levitt A, Kanade N, Wright-Jegede N, Dopson S, Biggerstaff M, et al. Community mitigation guidelines to prevent pandemic influenza—United States, 2017. MMWR Recomm Reports. 2017;66(1):1.
8. Fauci AS. An HIV vaccine is essential for ending the HIV/AIDS pandemic. Jama. 2017;318(16):1535–6.
9. Sharpe HR, Gilbride C, Allen E, Belij-Rammerstorfer S, Bissett C, Ewer K, et al. The early landscape of coronavirus disease 2019 vaccine development in the UK and rest of the world. Immunology. 2020;160(3):223–32.
10. US Centers for Disease Control and Prevention. COVID-19 Vaccines [Internet]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/index.html
11. Dal-Ré R, Stephens R, Sreeharan N. Let me choose my COVID-19 vaccine. Eur J Intern Med. 2021;87:104–5.
12. Jones I, Roy P. Sputnik V COVID-19 vaccine candidate appears safe and effective. Lancet. 2021;397(10275):642–3.
13. Cohen J. Dosing debates, transparency issues roil vaccine rollouts. American Association for the Advancement of Science; 2021.
14. Ghana Health Service. Ghana Health Service COVID-19 Dashboard [Internet]. [cited 2021 Nov 6]. Available from: https://ghanahalthservice.org/covid19/.
15. Report of The WHO SAGE Working Group on Vaccine Hesitancy.
16. MacDonald NE. SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. Vaccine. 2015;33(34):4161–4.
17. Larson HJ, Jarrett C, Eeckhertsberger E, Smith DMD, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. Vaccine. 2014;32(19):2150–9.
18. WHO. Emergencies: Ten threats to global health in 2019. 2019.
19. Jarrett C, Wilson R, O’Leary M, Eckersberger E, Larson HJ. SAGE Working Group on Vaccine Hesitancy. Stratag addressing vaccine hesitancy—A Syst Rev Vaccine. 2015;33(34):4180–90.

20. Cooper S, Betsch C, Sambala EZ, Mchiza N, Wiysonge CS. Vaccine hesitancy—a potential threat to the achievements of vaccination programmes in Africa. Hum Vaccin Immunother. 2018;14(10):2355–7.

21. Agyekum MW, Afrifa-Anane GF, Kyei-Arthur F, Addo B. Acceptability of COVID-19 vaccination among health care workers in Ghana. Adv Public Heal. 2021;2021.

22. Bell S, Clarke R, Mounier-Jack S, Walker JL, Paterson P. Parents’ and guardians’ views on the acceptability of a future COVID-19 vaccine: A multi-methods study in England. Vaccine. 2020;38(49):7789–98.

23. Reiter PL, Pennell ML, Katz ML. Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? Vaccine. 2020;38(42):6500–7.

24. Kalaitzaki AE, Tamiolaki A, Rovithis M. The healthcare professionals amidst COVID-19 pandemic: A perspective of resilience and posttraumatic growth. Vol. 52, Asian Journal of Psychiatry. Elsevier B.V.; 2020. p. 102172.

25. Kwok KO, Li K-K, Wei WI, Tang A, Wong SYS, Lee SS. Influenza vaccine uptake, COVID-19 vaccination intention and vaccine hesitancy among nurses: A survey. Int J Nurs Stud. 2021;114:103854.

26. Lazarus J V, 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(2):225–8.

27. Shaw J, Stewart T, Anderson KB, Hanley S, Thomas SJ, Salmon DA, et al. Assessment of US health care personnel (HCP) attitudes towards COVID-19 vaccination in a large university health care system. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2021;

28. Verger P, Soronias D, Dauby N, Adedzi KA, Gobert C, Bergeat M, et al. Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020. Eurosurveillance. 2021;26(3):2002047.

29. Shekhar R, Sheikh AB, Upadhyay S, Singh M, Kottewar S, Mir H, et al. COVID-19 vaccine acceptance among healthcare workers in the United States. Vaccines. 2021;9(2):119.

30. Machida M, Nakamura I, Kojima T, Saito R, Nakaya T, Hanibuchi T, et al. Acceptance of a COVID-19 Vaccine in Japan during the COVID-19 Pandemic. Vaccines. 2021;9(3):210.

31. Nzaji MK, Ngombe LK, Mwamba GN, Ndala DBB, Miema JM, Lungoyo CL, et al. Acceptability of Vaccination Against COVID-19 Among Healthcare Workers in the Democratic Republic of the Congo. Pragmatic Obs Res. 2020;11:103.

32. Salam M. COVID-19 vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. Vaccines. 2021;9(2):160.

33. Bono SA, Faria de Moura Villela E, Siau CS, Chen WS, Pengpid S, Hasan MT, et al. Factors Affecting COVID-19 Vaccine Acceptance: An International Survey among Low-and Middle-Income Countries. Vaccines. 2021;9(5):515.

34. Wang K, Wong ELY, Ho KF, Cheung AWL, Chan EYY, Yeoh EK, 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. 2020;38(45):7049–56.

35. Service GS. 2010 population and housing census report. Ghana Statistical Service; 2014.

36. Service GS. 2010 Population & housing census: National analytical report. Ghana Statistics Service; 2013.

37. Survey Sample Size.

38. Wang J, Jing R, Lai X, Zhang H, Lyu Y, Knoll MD, et al. Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. Vaccines. 2020;8(3):482.

39. Dzieciolowska S, Hamel D, Gadio S, Dionne M, Gagnon D, Robitaille L, et al. Covid-19 vaccine acceptance, hesitancy, and refusal among Canadian healthcare workers: A multicenter survey. Am J Infect Control. 2021:000:1–6.

40. Dror AA, Eisenbach N, Taiber S, Morozov NG, Mizrachi M, Zigron A, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. Eur J Epidemiol. 2020;35(8):775–9.

41. Adeniyi OV, Stead D, Singata-Madliki M, Batting J, Wright M, Jelliman E, et al. Acceptance of COVID-19 Vaccine among the Healthcare Workers in the Eastern Cape, South Africa: A Cross Sectional Study. Vaccines. 2021;9(6):666.

42. Fakonti G, Kyprianidou M, Toumbis G, Giannakou K. Attitudes and Acceptance of COVID-19 Vaccination Among Nurses and Midwives in Cyprus: A Cross-Sectional Survey. Front Public Heal. 2021;9(June):1–10.

43. Mesele M. COVID-19 Vaccination Acceptance and Its Associated Factors in Sodo Town, Wolaita Zone, Southern Ethiopia: Cross-Sectional Study. 2021:2361–7.

44. On K, Li K, In W, Tang A. Since January 2020 Elsevier has created a COVID-19 resource centre with
free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company’s public news and information. *Int J Nurs Stud.* 2020;114(January):103854.

45. Islam MS, Kamal A-HM, Kabir A, Southern DL, Khan SH, Hasan SMM, et al. COVID-19 vaccine rumors and conspiracy theories: The need for cognitive inoculation against misinformation to improve vaccine adherence. *PLoS One.* 2021;16(5):e0251605.

46. Romer D, Jamieson KH. Conspiracy theories as barriers to controlling the spread of COVID-19 in the US. *Soc Sci Med.* 2020;263:113356.

47. van Mulukom V, Punmerer L, Alper S, Cavojova V, Farias JEM, Kay CS, et al. Antecedents and consequences of COVID-19 conspiracy theories: a rapid review of the evidence. 2020;

48. Pivetti M, Melotti G, Bonomo M, Hakoköngäs E. Conspiracy Beliefs and Acceptance of COVID-Vaccine: An Exploratory Study in Italy. *Soc Sci.* 2021;10(3):108.

49. Ebrahimi O V, Johnson MS, Ebling S, Amundsen OM, Halsøy Ø, Hoffart A, et al. Risk, Trust, and Flawed Assumptions: Vaccine Hesitancy During the COVID-19 Pandemic. 2021;

50. Elhadi M, Alsoufi A, Alhadi A, Hmeida A, Alshareea E, Dokali M, et al. Knowledge, attitude, and acceptance of healthcare workers and the public regarding the COVID-19 vaccine: a cross-sectional study. *BMC Public Health.* 2021;21(1):1–21.

51. Reiter PL, Pennell ML, Katz ML. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company’s public news and information. *Vaccine.* 2020;38(January):6500–7.

52. Tsai F-J, Hu Y-J, Chen C-Y, Tseng C-C, Yeh G-L, Cheng J-F. Using the health belief model to explore nursing students’ relationships between COVID-19 knowledge, health beliefs, cues to action, self-efficacy, and behavioral intention: A cross-sectional survey study. *Medicine (Baltimore).* 2021;100(11).

53. Fincham JE. Response rates and responsiveness for surveys, standards, and the Journal. *Am J Pharm Educ.* 2008;72(2).

54. Koen B, Loosveldt G, Vandenplas C, Stoop I. Response Rates in the European Social Survey: Increasing, Decreasing, or a Matter of Fieldwork Efforts? Surv Methods Insights from F. 2018;1–12.