HUMAN VACCINES & IMMUNOTHERAPEUTICS
2021, VOL. 17, NO. 11, 3881–3886
https://doi.org/10.1080/21645515.2021.1963600

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RESEARCH PAPER

Non-life-threatening adverse reactions from COVID-19 vaccine; a cross-sectional study with self-reported symptoms among Ghanaian healthcare workers

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ABSTRACT

Health-care professionals in Ghana were among the prioritized high-risk groups to be administered with the initial supply of Oxford/AstraZeneca vaccine procured by the Government of Ghana. This study sought to assess and identify the determinants of COVID-19 vaccine short-term side effects among health-care workers. A cross-sectional study was conducted on 654 Ghanaian healthcare workers between 16th March and 5th May 2021. The study included health-care workers in registered health settings, who had been vaccinated against COVID-19 and consented to participate in the survey. Descriptive statistics, binary and multivariable logistic regression analyses were executed using SPSS version 22 at $p < .05$. The findings revealed that, 528 (80.7%) of the participants experienced adverse reactions, which lasted between 0 and 2 days among, 347 (53.1%) of the study participants. The most reported adverse reactions were general body weakness, 434 (32.0%), headache 371 (27.3%), and fever, 257 (19.1%). Health workers aged 35–39 and 40–44 years had lower odds of adverse reactions compared with those aged 25–29 years (aOR: 0.34, 95% C.I. 0.186,0.621, $p < .001$) and (aOR: 0.42, 95% C.I. 0.201,0.890, $p = .023$). Taking analgesics before vaccination decreased the likelihood of adverse reactions (aOR: 0.28, 95% C.I. 0.185,0.427, $p < .001$). High prevalence of adverse reactions was found among the healthcare workers, however short-lived. The most reported systemic adverse reactions were general body weakness, headache, and fever. We recommend intensification of campaigns on COVID-19 vaccines and their associated adverse effects to avoid the negative implication on uptake among the healthcare workers and the general population.

ARTICLE HISTORY
Received 18 May 2021
Revised 14 July 2021
Accepted 28 July 2021

KEYWORDS
word; COVID-19; COVID-19 vaccine; adverse reactions; symptoms

Introduction

The novel Corona Virus disease (COVID-19), an infectious respiratory virus, was discovered in Wuhan, China, claiming several millions of live globally. According to the available situational reports, Africa recorded over 2 million COVID-19 cases and over 49,000 deaths.[1] COVID-19 overwhelmed the health-care systems worldwide and in the case of Africa, resource constraints led to comparatively lower access to COVID-19 diagnostic testing, resulting in underdiagnoses, especially in asymptomatic or pauci-symptomatic individuals, and restricted basic and advanced treatment to prevent morbidity and mortality.[2–4]

Governments worldwide have imposed several measures and protocols such as "travel bans, the mandatory wearing of nose masks, lockdowns, social distance, and frequent washing of hands with soap and under running water" to help halt the spread of COVID-19.[5] Researchers and scientists from China, the United Kingdom, the United States and other developed countries also embarked on the quest to produce several vaccines to curb the further spread, deaths and the devastating socioeconomic impact of COVID-19. Over 200 vaccine candidates are pursued globally; however, there is still uncertainty about the production of a stable and highly immunogenic COVID-19 vaccine.[6] The Food and Drug Administration (FDA) of the United States, Canada, and the United Kingdom granted authorization for Pfizer/BioNTech, Moderna, and AstraZenecca administration following successful clinical trials.[7–9]

On 20th December, 2020, the Government of Ghana (GoG) had publicly stated its intention to commence procurement of the Oxford/AstraZeneca and Sputnik V COVID-19 vaccines for use in the region. AstraZenecca is shown to have 94.1% efficacy in prevention of COVID-19 illness, including severe disease in persons aged 18 years or older.[10] On February 24, 2021, Ghana received 600,000 doses of AstraZenecca and due to a global limited supply of COVID-19 vaccines, the

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government gave priority to high-risk groups for the initial supply of vaccines.[5] Healthcare worker (HCWs), the elderly, especially those with chronic co-morbid disorders, and those in critical services are among the high-risk categories. HCWs are at a heightened risk of contracting COVID-19 due to direct or indirect contact with bodily secretions of COVID-19 patients/clients and visitors.[11,12] In Ghana, as of March 12, 2020, nearly 1,629 nurses and midwives, had been infected with the virus, with 4 deaths and more than 450 doctors and dentists had been contaminated with COVID-19, with 7 deaths.[5]

Available data from COVID-19 vaccines clinical trials revealed that side effects such as redness, fever, nausea, vomiting, dizziness, general body weakness, headache, anaphylaxis, and swelling at the site of vaccination injection were reported among some of the participants.[13] A recent research on self-reported adverse effects with the mRNA-1273 vaccine among HCWs revealed a wide range of symptomatology, with the majority of the symptoms being non-life threatening.[14] In some instances, side effects were significantly more common in women than in men, in individuals aged 55 years or younger than in those older than 55 years.[15]

It is important to identify and track vaccine adverse effects – to increase vaccine safety and uptake. Since there are few studies on the experience and adverse effects/reactions of COVID-19 vaccines in Ghana and even globally, this study sought to ascertain the incidence of short-term adverse reactions from COVID-19 vaccination among health care professionals who had already taken the first dose of the vaccine in Ghana.

Methods

Study settings

Ghana, a west African country in Sub-Saharan Africa, is the only English-speaking country bordered by three French-speaking nations, Burkina Faso on the north, Togo on the east, Cote d'Ivoire on the west and the Gulf of Guinea by the south. Ghana is categorized as a lower-middle-income country, with a population of about 30.9 million people and 16 administrative regions. A total of 357 hospitals, 1004 health centers, 140 district hospitals, 998 clinics, and 5,421 Community-based Health Planning and Services (CHPS) were established in Ghana as of 2017. Similar to most African countries, Ghana health care systems, infrastructures and human resources are not equitably distributed as most of the health facilities and health workers are overwhelmingly concentrated in the Ashanti and Greater Accra regions, especially in urban areas. For example, of Ghana's 357 hospitals, 128 (35.9%) are located in the Ashanti region, 99 (27.7%) in the Greater Accra region and 9 (2.5%) are located in the Western Region. In addition, Ghana has 4,016 doctors as of 2017, with almost 39.4% located in the Greater Accra region and 20.5% located in the Ashanti region.[5,16]

Study design

A cross-sectional study was conducted among Ghanaian healthcare workers between 16th March and 5th May 2021. This survey adopted both convenient and snowballing sampling techniques due to the existing nature of the pandemic. This method was chosen because it provides sufficient social distancing, limit physical contact with respondents and eliminates movements of researchers or volunteers and get responses quickly as far as possible amidst the outbreak. A simple close and open-ended questionnaire tool was developed on google form and shared via WhatsApp platforms of Healthcare workers and to reach out to more health professionals, a snowball approach was used, in which respondents were encouraged to forward or share the online survey contact with other health workers.

Eligibility criteria

The study included clinicians, nurses, midwives, pharmacists, biomedical scientists, community health works, and other healthcare providers practising in both registered private and public health settings in Ghana, who have vaccinated against COVID-19 and consented to participate in the survey. Healthcare workers who had not taken at least one COVID-19 vaccine shot, who refused to consent and those with incomplete data were excluded. Participants aged below 18 years were also excluded because of their vulnerability as minors.

Sample size estimation

The minimum sample size was estimated using the Cochrane formula $n = \frac{Z^2pq}{e^2}$; given that Z (at 95% confidence interval) = 1.96, the prevalence was set at 50% (to assume an equal distribution or variability), hence p = .50, q(1-p) = 0.50, and e (margin of error) = 0.05, 380 participants were required. Factoring in the 10% non-response rate during the study, at least 418 participants were needed for the analysis. However, this study recruited 654 healthcare professionals.

Data collection

The developed questionnaire covered two sections, sociodemographic characteristics of the study participants and COVID-19 related adverse reaction questions. The demographic information such as age, gender, marital status, education, and profession were solicited from the participants. In addition, information on preexisting medical conditions and whether or not participants took pain medications before the administration of the COVID-19 vaccine were collected. Participants were also asked questions on the experience of adverse reaction(s) from the vaccine, type of adverse reaction, and duration of reaction (s).

Measurement and variables

Adverse side effects in this study were defined as non-life threatening symptoms within 0–8 days after vaccination, this was the dependent variable and it was assessed using the question "experienced an adverse reaction/effects after receiving the first shot of vaccine" and the responses were "Yes" and "No." The independent variables were gender, preexisting medical condition, types of adverse reaction and duration of reaction in days.

Ethical consideration

According to the GHS-ERC guidelines/standard operating procedures; research studies that are considered for exemption are minimal risk research studies that conform to one or more of the following categories of research. Research involving the use of educational tests, survey procedures, interview procedures or observation of public behavior EXCEPT if information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects.[17]

Data used was obtained in adherence to the principles of the declaration of Helsinki and local regulatory requirements. Participants aged below 18 years were excluded because of their vulnerability as minors. Prior to the participation, the purpose of study, the confidential and voluntary nature of the survey and the estimated time it will take to complete the questionnaire were explained to potential respondents. Respondents were also informed that by choosing to access the survey link, they are providing their consent to participate.

Data analysis

All statistical analyses were executed using Statistical Package for the Social Science (SPSS; IBM, USA), Version 22. Descriptive statistics were estimated for all variables and presented as percentage (%) or number (n). To identify the factors associated with the short-term adverse reaction, a binary logistic regression analysis was conducted at $p < .10$. The variables significant at $p < .10$ were further analyzed using multivariable logistic regression model, adjusted for confounding factors using stepwise method of forward likelihood ratio (Entry $p < .05$, Removal $p > .1$). .Statistical significance was set at $p < .05$.

Results

Sociodemographic characteristics of healthcare workers

Table 1 presents the sociodemographic characteristics of the study participants. The age ranged from 25 to 44 years, mean age of 32.24 ± 4.30 years and the most aged 30–34 (48.5%). A significant number of the healthcare professionals were males, 335 (51.2%), single, 324 (49.5%), attained degree certificate, 337 (51.5%) and nurses by profession, 269 (41.1%).

Table 1. Sociodemographic characteristics of healthcare workers.

Characteristics	Participants (N)	Percentage (%)
Age Mean = 32.24 ± 4.30 min = 25 max = 44		
25–29	168	25.7
30–34	317	48.5
35–39	110	16.8
40–44	59	9.0
Gender		
Female	319	48.8
Male	335	51.2
Marital status		
Single	324	49.5
Married	318	48.6
Ever married	12	1.8
Education		
High School	24	3.7
Diploma	293	44.8
Degree	337	51.5
Profession		
Nurses	269	41.1
Biomedical Scientists	229	35.0
Clinicians	36	5.5
Pharmacists	39	6.0
Community Health Personnel	34	5.2
Health officers	39	6.0
Nutritionist	8	1.2

Table 2. Short-term adverse reaction after COVID-19 vaccine administration.

Statement	Participants (N)	Percentage (%)
Do you have any underlying medical conditions?		
Yes	91	13.9
No	563	86.1
Medication (Paracetamol) to avoid any reaction before the shot?		
Yes	271	41.4
No	383	58.6
Did you experience any adverse reaction		
Yes	528	80.7
No	126	19.3
What side reactions did you experience after the short?		
Headache	371	27.3
General body weakness	434	32.0
Dizziness	105	7.7
Nausea and vomiting	32	2.4
Swelling at site of injection	68	5.0
Sour mouth	8	0.6
Night sweats	10	0.7
Body itching	11	0.8
Fever	259	19.1
Insomnia	8	0.6
Altered menstrual cycle	14	1.0
Pain	37	2.7
How long did the reaction last? (days)		
0–2	347	53.1
3–5	142	21.7
≥6	39	6.0

Short-term adverse reaction after COVID-19 vaccine administration

The majority of the healthcare workers had no underlying medical condition, 563 (86.1%) and 271 (41.4%) took medication, paracetamol, before the vaccine administration to avoid unwanted adverse reactions. The majority experienced an adverse reaction, 528 (80.7%) which lasted between 0 and 2 days among most of the participants, 347 (53.1%). The most reported short-term adverse reactions were general body weakness, 434 (32.0%), headache 371 (27.3%), and fever, 257 (19.1%) (Table 2).

Association between the length of adverse reaction by age of participants

Figure 1 depicts that the ages of participants were significantly associated with the duration of adverse reactions. The most frequent duration of adverse reactions reported among the age groups was 0–2 days, however, the adverse reactions lasted for 3–5 days among the participants aged 40–44 years. No significant association was observed between gender, preexisting medical conditions, pain medication and length of adverse reactions among the healthcare workers.

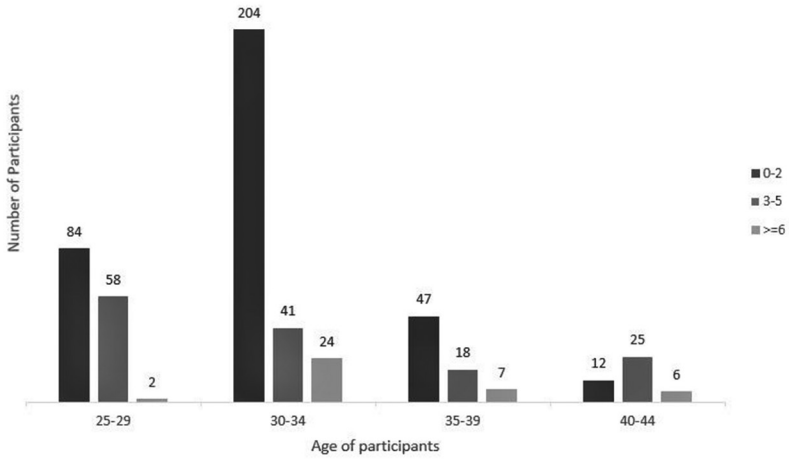

Figure 1. Length of adverse reaction by age of participants.

Factors associated with short-term adverse reaction among the healthcare professionals

The regression depicted age and medication use were significantly associated with the risk of experiencing short-term adverse reaction both in the bivariate and multivariate analyses. Health worker aged 35–39 years had lower odds of adverse reactions from COVID-19 vaccine administration compared with those aged 25–29 years (aOR: 0.34, 95% C.I. 0.186,0.621, $p < .001$). Also, the likelihood of experiencing adverse reactions was lower in participants aged 40–44 years compared with those aged 25–29 years (aOR: 0.42, 95% C.I. 0.201, 0.890, $p = .023$). Participants who administered medication, thus paracetamol before COVID-19 vaccine injection had less likelihood of experiencing adverse reactions compared to those who took no pain medication (aOR: 0.28, 95% C.I. 0.185,0.427, $p < .001$) (Table 3).

Discussion

Healthcare professionals in Ghana were among the prioritized high-risk groups to be administered with the initial supply of Oxford/AstraZeneca vaccine procured by the Government of Ghana. There is paucity of data on non-life-threatening side effect of the Oxford/AstraZeneca vaccine within the high-risk group of Ghanaian and healthcare professionals to have received the first shot. This study sought to assess and identify the determinants of COVID-19 vaccine short-term side effects among healthcare workers in Ghana. We found that significant number of the healthcare professionals who had been vaccinated were males. This finding is confirmed by a study conducted on the acceptability of COVID-19 Vaccination among healthcare workers in Ghana prior to the procurement and importation into the country. The study reported that the probability of female health care workers receiving the COVID-19 vaccines if available was less compared with males.[5] This result supports other observational findings that show male healthcare workers are more likely than the female to consider COVID-19 vaccines.[18,19]

This gender disparity in the vaccination may be attributable to the perception that men have higher risk of infection and death from the disease than women. Also, men are naturally bold to receive the vaccine as a sign of the inherent nature of how they were created as courageous beings. We also observed that nurses formed a greater proportion of our study participants compared to the other professionals. However, Agyekum

Table 3. Factors associated with short-term adverse reaction among the healthcare professionals.

Characteristics	Adverse reaction		Unadjusted OR [95% CI]	*P*-value	Adjusted OR [95% CI]	*P*-value
Age	Yes (%)	No (%)				
25–29	144(85.7)	24(14.3)	1		1	
30–34	269(84.9)	48(15.1)	0.93[0.550,1.587]	0.801	0.94[0.544,1.613]	.813
35–39	72(65.5)	38(34.5)	0.32[0.176,0.556]	<0.001*	0.34[0.186,0.621]	<.001*
40–44	43(72.9)	16(27.1)	0.45[0.218,0.919]	0.028*	0.42[0.201,0.890]	.023*
Gender						
Female	265(83.1)	54(16.9)	1		1	
Male	263(78.5)	72(21.5)	0.74[0.503,1.101]	0.116	-	-
Existing medical condition						
No	449(79.8)	114(20.2)	1		1	
Yes	79(86.8)	12(13.2)	1.67[0.880,3.173]	0.812	-	-
Medication (paracetamol) to avoid any reaction before the shot?						
No	187(69.0)	84(31.0)	1		1	
Yes	341(89.0)	42(11.0)	0.27[0.182,0.414]	<0.001*	0.28[0.185,0.427]	<.001*

et al.,[5] reported a high likelihood of COVID-19 vaccine acceptance in medical doctors compared to nurses and other health workers. According to Ghana Health Service, 2017 facts and figures report, nurses to medical doctors ratio was 68,493: 4,016, thus 17:1,[16] this could explain why nurses formed a greater proportion of who had vaccinated.

Few of the healthcare workers had an underlying medical condition and the probable explanation is that healthcare workers are more educated, have gained more knowledge and understand the relevance and practice of a healthy lifestyle on human health and consequently less likely to suffer from chronic illness. Similarly, we observed few of the healthcare workers took pain medications like paracetamol, before the vaccine administration to avoid unwanted adverse reactions. This could be explained by the array of information available to health workers on the avoidance of pain killers before or after COVID-19 vaccination as it may theoretically reduce the immune response to the vaccine.

The majority of our study participants experienced mild adverse reactions from the vaccine, which lasted mostly between 0 and 2 days. Much of this was expected because, since the rolling in of the COVID-19 vaccination, people around the world have reported temporary side effects.[7,14] This observation may have a critical implication on the willingness of these individuals to accept the second dose of the vaccine. As a result, it is critical for the government to continue to sensitize the healthcare workers that the protection conferred by the COVID-19 vaccine far outweighs the risk of adverse reactions. This probably will strengthen their zeal to take the second shot. Since healthcare workers are a credible source of knowledge on vaccination to patients, their negative response to the COVID-19 vaccines can affect the COVID-19 vaccine's adoption in the general population.

The most reported systemic adverse reactions among our study participants were general body weakness, headache, and fever. Similarly, a report from a clinical trial in the UK found that systemic adverse reactions such as headache and fatigue, injection-site pain were frequently reported after the first dose.[7] Also, Kadali et al.,[14] found that their health workers reported symptoms such as regional pain, fatigue, headache among others during the initial stages of the post vaccination period. These findings were much anticipated since data from clinical trials on the vaccines authorized so far suggested the plausible reactions the general populace must expect.

A significant association was found between age and the duration of reported adverse reactions. Older individuals are more susceptible to pain and poorly managed compared to younger persons as reported by Schofield, Pat,[20] and this could explain why pains in the older healthcare workers lasted longer than that of the younger workers.

The regression depicted age and medication use were significantly linked to the risk of experiencing short-term adverse reaction(s) both in the bivariate and multivariate analyses. Health workers aged 35–39 years and 25–29 years had lower odds of adverse reaction from COVID-19 vaccine administration compared with those aged 25–29 years. Data from other community-based surveys provide evidence to support our reports of higher frequency of side-effects in younger than in older individuals.[10,21] The possible explanation could be the increase in titer of post vaccine expression of counterbalance antibodies in younger people,[22] confirming the association between age and symptoms of adverse conditions in this study. Furthermore, it suggests that, immune- mediated mechanisms resulting in increased reactogenicity responsible of symptoms expressions.

According to AstraZeneca Company, prophylactic use of paracetamol can reduce some symptoms. In this study, HCWs who took medication, i.e., paracetamol before the COVID-19 vaccine injection had less likelihood of suffering from adverse reaction compared to those who took no pain medication. This finding was much expected because the analgesic blocks the pain receptors and numbness thereby experiencing minimal or no unpleasant side reactions compared with their counterparts.[20] However, it must be noted that the immune response in the healthcare workers who took the pain medications might be lesser than the other group as aforementioned. Overall, this recent study fills the knowledge gap of non-existing data on self-reported non-life threatening adverse effect of the COVID-19 vaccine from high-risk healthcare personnel in Ghana. It also delivers supplementary evidence to the general populace about the transient adverse effects of the vaccines to eschew negative publicity, myth and misinformation to increase population vaccine willingness.

Limitations of the study

This study was not without limitations, the findings from this study are self-reported and not verified or confirmed by the investigators. This study did not take into account the implication of the reported side-effects on the willingness to uptake the second dose. There is possibility of a recall bias, as those filling the questionnaire might be those experiencing symptoms more frequently. Also, because of the cross-sectional nature of the study, the investigators could not ascertain the cause and effect relationship between COVID-19 vaccination and post-vaccination adverse reaction.

Conclusion

A high prevalence of non-life threatening adverse reactions was found among the Ghanaian healthcare professionals, however short-lived. The most reported systemic adverse reactions among our study participants were general body weakness, headache, and fever and often lasted 0–2 days. Younger participants and individuals who refused administration of pain medication prior to the vaccination reported adverse reactions more frequently compared to their counterparts. This finding could inform stakeholders of the gender and pain medication variation in the development of the post-vaccination adverse reactions. We recommend intensification of campaigns on COVID-19 vaccines and their associated adverse effects. An educational strategy of this kind should include factual information, discuss the various vaccination issues, and answer questions regarding the COVID-19 vaccines misconception.

Acknowledgments

We are grateful for the immense contributions healthcare workers in Ghana for participating in this study.

Authors' contributions

Authors SD, FOB and CN conceived. Authors SD, SA, FOB and CN designed and participated in the data collection. Authors SD, RA, MHA EYW and EO analysed and interpreted the data. Authors FOB, CN, EL, MHA, TAB and MD conducted the literature search and wrote the first draft of the manuscript. All authors critically reviewed, revised and approved the final manuscript.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

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