

# Socioeconomic and demographic characteristics influencing the hesitancy and refusal of COVID-19 vaccine in Ghana

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*Ther Adv Vaccines Immunother*

2023, Vol. 11: 1–15

DOI: 10.1177/  
25151355221149336

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## Abstract

**Background:** Ghana was the first country to receive the coronavirus vaccination in West Africa from AstraZeneca or Oxford. Ghana plans to vaccinate 20 million out of the 32 million population and provide the necessary doses utilizing multilateral and bilateral agreements. As Ghana begins vaccinating its citizens, there is some skepticism about administering the coronavirus vaccine (CVV). This research aimed to analyze the socioeconomic and demographic characteristics influencing vaccine hesitancy (VH) and refusal among Ghanaians.

**Methods:** The multinomial logistics regression model was employed to investigate the relationship between respondents' socio-demographic characteristics and VH. The research data were gathered between March to June 2021 through an online survey.

**Findings:** The findings of this study indicated that approximately 92.75% of the 400 respondents have heard about CVV. The study suggests that less than 5% of the participants have so far received the CVV. Most of the respondents (36.8%) indicated rejecting the CVV. Interestingly, male participants [adjusted odds ratio (AOR)=1.048; 95% confidence interval (CI): 0.532–2.063] with higher educational backgrounds (AOR=2.11; 95% CI: 0.870–5.121) had higher odds of being CVV hesitant or refusers. Low economic class, rural settlers, unmarried individuals, and unemployed people also had higher odds of being VH or refusers. The survey also shows that most Ghanaians refused to receive the CVV because they did not trust the system to track the vaccine's side or adverse effects.

**Conclusion:** Government can use social media platforms and other media platforms to effectively provide relevant information regarding the full benefit and risks of taking the virus.

**Keywords:** coronavirus vaccine, COVID-19, Ghana, hesitancy, vaccine

Received: 18 January 2022; revised manuscript accepted: 19 December 2022.

## Introduction

The non-availability of a vaccine has yielded an increasing number of virus deaths. Herd immunity was proposed as a potential treatment at the coronavirus pandemic's initial stage.<sup>1</sup> To curb the spread of coronavirus prevalence in Ghana, Ghana's Government decided to vaccinate its citizen. After a year of disruptions due to the COVID-19 pandemic, with more than 90,000 Ghanaians getting infected with the virus and over 700 lost lives, the path to recovery for the

people of Ghana can finally begin. This is a momentous occasion, as the arrival of the COVID-19 Vaccines Global Access (COVAX) brings hope to the nation and the world. The coronavirus vaccine (CVV) in Ghana is critical in ending the pandemic. The only way out of this crisis is to ensure vaccinations are available. The great contribution of the partners supporting the COVAX Facility to deliver safe and effective COVID-19 vaccines to all countries quickly and fairly is highly appreciated.

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Thus, the trend of Ghana's COVID-19 vaccine issues was released and spearheaded by UNICEF representatives in Ghana.<sup>2</sup>

The World Health Organization (WHO), the European Commission, and France launched COVID-Vaccines Global Access, abbreviated as (COVAX), a component of the Access to COVID-19 Tools (ACT), as a worldwide strategic approach to the coronavirus pandemic.<sup>3</sup> COVAX is a global initiative co-led by WHO, Gavi, and the Coalition for Epidemic Preparedness Innovations. It seeks to develop, produce, and distribute CVV to all countries fairly and transparently. It is a funding source that achieves competitive prices by leveraging its collective buying power. As part of the first COVAX batch, Ghana anticipates receiving the COVID-19 vaccines by the end of March 2021, up to 968,000 doses of Oxford-AstraZeneca. The first doses were for approximately 108,000 people in the nation's health workforce.<sup>2</sup>

The World Health Organization Strategic Advisory Group of Experts (WHO SAGE) working group (WG) defines VH as the delay in accepting or refusing vaccination despite the availability of vaccination services.<sup>4</sup> One of the most severe health problems globally is vaccine reluctance or hesitancy.<sup>5,6</sup> In elaborating on the context, the WG asserted that reluctance was a behavioral phenomenon that was vaccine-specific and context-specific and is measured in the light of the available immunization services against an expectation of meeting a specific vaccine coverage goal.<sup>7</sup> Research conducted by Marti *et al.*<sup>8</sup> indicated that while high hesitancy levels lead to lower demand for vaccines, low hesitation levels do not always lead to a higher demand for vaccines. The VH Determinants Matrix categorizes the factors influencing behavioral choices to take some vaccines, delay or reject them, or all vaccines into three categories: contextual, individual and group, and vaccination-specific issues. Vaccine investigation coverage is usually undertaken to examine the impact of individual socioeconomic factors on vaccination rates. These studies have yielded contradictory results regarding associations between low socioeconomic status and conformance with vaccination schedules.<sup>9</sup> In addition, Zhou *et al.*,<sup>10</sup> discovered using web-based social media interventions to promote early childhood immunization. Even though vaccines

are widely considered a tremendous public health strategy, some media messages are filled with doubt and misinformation regarding vaccination's potency, contributing to VH.

Moran *et al.*<sup>11</sup> recounted a gap in complete socio-demographic vaccination, although Ghana has high average immunization rates. With the revisions of the vaccine recommendations, all children must have equitable access to immunization irrespective of population and socioeconomic background. Dubé *et al.*<sup>12</sup> also show that vaccine specialists and front-line suppliers are assumed to drop. The study identified the fundamental causes of VH: the spread of negative online information and a lack of knowledge about vaccines. A common understanding of VH impact among research groups, public health officials, lawmakers, and health professionals may help inform initiatives to address vaccine hesitation in Ghana more effectively.<sup>13</sup> It was found that numerous researchers relied on grasping and specifying the new medical term, VH; few have tried to sum up programs and strategies for historical and contemporary public health, successful or ineffective, in addressing this ongoing trend. The study of Marti *et al.*<sup>8</sup> concluded the following: (1) the risk-benefit share in vaccines, (2) understanding and information concerns, and (3) religious, cultural, sex, or social and economic variables. There were pressing issues with the fear of side effects and inadequate information about vaccination or immunization services. Henry *et al.*<sup>14</sup> observed that more extensive human papillomavirus infection (HPV) vaccination reportage in cities and minority groups in low-income areas could be due to vaccine acceptance and healthcare practices. While social and economic variables may play an essential and direct role in inefficiency issues, the dynamic relationships between confidence and complacency-related matters are impossible to understand. VH is multifaceted, context-dependent, and varies by time, region, and disease type. Characteristics like complacency, convenience, and confidence also influence VH. Similarly, public skepticism or trust can be exacerbated by misinformation and politicization of the COVID-19 pandemic, vaccine approval, and deployment procedures.<sup>7,15</sup>

Bertoncello *et al.*<sup>16</sup> emphasized that economic distress was a factor in VH. Low education is forecasted as a refusal factor but does not have an

enormous impact on hesitancy. These research results can provide general insight and predictive analytics for social and economic disparities within universal healthcare systems. Insight into these factors is needed to improve convenience and eliminate potential access issues.<sup>17</sup> See VH as a concept encompassing uncertainty, unpredictability, postponement, and unwillingness to accept the vaccine. Moreover, the researcher stressed that VH is complex with many determinants, including history, geographic location, economic instability, convenience, and vaccine confidence.

Various vaccination programs were carried out in Ghana before the COVID-19 vaccination. Vaccination is not a new phenomenon in Ghana; however, most Ghanaians find it very difficult to come to terms with it. Table 1 provides a summary of the National Immunization Schedule that has taken place in Ghana. This study's objective was to analyze the impact that socioeconomic and demographic characteristics have on Ghanaians' decision to hasten or refuse to receive

the CVV in Ghana. This study sheds light on these issues and analyzes why Ghanaians refuse and hesitate to accept the CVV administration. The research provides first-hand information on socioeconomic and demographic characteristics of CVV hesitancy and refusal in Ghana, one of the most affected countries in West Africa, during this COVID-19 pandemic. The survey analysis also outlined practical measures to increase vaccine acceptance in Ghana. Health authorities and the Government of Ghana should appropriately address the determinants analyzed in this article to accept future vaccines among Ghanaians.

## Materials and methods

### *Participants of the study*

This research was conducted in Ghana, located in West Africa, with a population of over 30 million. A cross-sectional survey was conducted from (March–June 2021). A well-structured questionnaire of 500 questions was piloted online to

**Table 1.** National immunization schedule in Ghana.

Vaccine	Description	Schedule
BCG	Bacille Calmette–Guérin vaccine	Birth
OPV	Oral polio vaccine	Birth; 6, 10, 14 weeks
Rotavirus	Rotavirus vaccine	6, 10 weeks
DTwPHibHepB	Diphtheria and Tetanus, and Pertussis and Haemophilus influenza and Hepatitis B vaccine	6, 10, 14 weeks
Pneumo_conj	Pneumococcal conjugate vaccine	6, 10, 14 weeks
IPV	Inactivated polio vaccine	14 weeks
YF	Yellow fever vaccine	9 months
MR.	Measles and rubella vaccine	9, 18 months
Measles	Measles vaccine	18 months
MenA	Meningococcal A vaccine	18 months
Adolescent Infant Vaccination Schedule		
Td	Tetanus and diphtheria toxoid for older children/adults	First contact; +1, +6 months; +1 year
COVID-19 vaccine	AstraZeneca/Oxford vaccine	18 years

Source: Modified from World Health Organization.<sup>18</sup> COVID-19, coronavirus disease 2019.

Ghanaian citizens above 18 years selected for the study. Out of the 500 distributed questionnaires sample size, 400 were received. Respondents for this study were selected through a specific sampling (which includes a non-random selection of elements based on the researcher's judgment and knowledge). We believed the participant might know about the CVV. Purposive sampling was used to identify the most likely respondents to produce relevant results. It is a way of analyzing and selecting cases that will effectively use limited research resources.<sup>19</sup> The purposive sampling approach allows the researcher to choose from a wide range of respondents among a large sample size.<sup>19-21</sup>

#### *Data collection*

Social media platforms distributed most research questionnaires to relatives, friends, government workers, students, and the general public. At the beginning of the distribution of the study questionnaires, a declaration of confidentiality was received. Other respondents preferred answering on mobile phones or answering the questionnaire with an interviewer's aid. The 400 questionnaires were analyzed and coded using the IBM SPSS Statistical tool, Windows version 24.0.

#### *Study variables and measures*

The research questionnaires evaluate the relevance of socioeconomic and demographic characteristics influencing the hesitancy and refusal of CVV in Ghana. Socioeconomic and demographic indicators adopted for the study were as follows:

- Age categories of the respondent: (18–24, 25–29, 30–34, 35–39, 40–45, 45 and above)
- Sex: Male and Female
- Religious affiliation: Christianity, Islamic, Traditionalist, and others
- Highest education level: University, Senior High School, Junior High School
- Wealth status: Poor, Middle, and Rich
- Marital status: Single, Married, Divorced, and others
- Residential type: Rural and Urban
- Work status: Employed and Unemployed

These demographic categorizations were selected based on previous research evaluating VH among

Ghanaians and other geographical areas.<sup>10,22,23</sup> The study adopted the WG questionnaires on VH.<sup>4</sup> The WG proposed a list of survey questionnaires that different nations can employ to better understand VH factors in a particular setting. Table 2 explains the questionnaire model adopted for the studies. Various questions regarding vaccination hesitancy were asked to elicit responses from the general public to understand this phenomenon better. The questionnaires also consider three key areas; the respondent's contextual influence, individual and group influencers, and vaccination-specific issues.

Contextual influence in this study mainly concerns historical, cultural, ecological, medical services, and social and economic variables affecting people refusing vaccination. Individual and group influencers focus on the various variables that span from a unique perception of immunization or the society's peer pressure influence. Vaccination-specific issues entail safety issues and adequate information about the vaccine's adverse effects.<sup>24</sup> Our findings emphasize the importance of addressing VH, particularly in the aftermath of vaccine incidents. The Cronbach's alpha coefficient of the construct from the study outcome indicates that all the parameters meet the threshold recommended by previous studies of 0.70.<sup>25,26</sup>

#### *Statistical analysis*

This section analyzes the descriptive statistic about the participants' socioeconomic and demographic characteristics. VH's generality was evaluated as the percentage of no VH, refusers, acceptors with doubts, and delayers in the total survey sample. The multinomial logistics regression model was employed to analyze the relationship between respondents' socioeconomic and demographic characteristics and VH. The 'No vaccine hesitancy' category was used as the reference for group comparison. The researchers also analyzed the VH reasons developed according to the proposed WG determinants, including contextual influence, individual and group influence, and vaccine-specific issues. The adjusted odds ratios (AOR) and 95% confidence intervals (CIs) are employed in this study to present the associations' stability. All tests were statistically significant at a *p*-value of 0.05.

**Table 2.** Determinants of vaccine hesitancy adopted for the study.

Measure	Cronbach's $\alpha$
Contextual influence	
There is adequate communication about the administration of the vaccine	0.766
Trust in government decision in enrolling the vaccination in Ghana	0.876
Event from the past has discouraged me from taking the vaccine	0.775
The administration of the vaccine is politically influenced	0.719
There is too much time to be spent on taking the vaccine	0.864
I trust the pharmaceutical industry to produce the vaccine	0.813
Individual and group influence	
I believe that there are better ways to stop the spread of COVID-19 than vaccination	0.816
I think the vaccines are safe for myself, my family, and my country	0.764
I think vaccine benefits, in general, are more significant than their risk	0.767
I feel social pressure to get the vaccine	0.787
I have a fear of taking the vaccine	0.814
I believe that there are better ways to stop the spread of COVID-19 than vaccination	0.709
Vaccination-specific issues	
Trust in the mode of administration of the vaccine	0.808
Confidence in the design of the vaccination program	0.831
I can quickly and conveniently access the immunization center for vaccination	0.776
Health professionals recommend that I receive the vaccine	0.853
Five-point Likert-type scale from strongly disagree, disagree, neutral, agree, strongly agree. COVID-19, coronavirus disease 2019.	

## Results

### *Demographic and socioeconomic characteristics*

The research included 400 respondents to analyze the factor associated with demographic and socioeconomic characteristics of the CVV hesitancy and refusal. Table 3 indicates that, out of the 400 participants, 266 (66.5%) were male, and 144 (33.5%) were females in Ghana. Most of the respondents' age range between 25 and 35 years, 59.3%; followed by 19.5% within the scope of 18–24 years; and older people represented 7%. The respondents' religious affiliation revealed that 80.8% were Christians, 11.8% were Muslims,

and 7.4% were Traditionalists. Most of the participants' educational backgrounds have had a university education (65%), and 10.7% of the respondents also had junior high school education. The majority (66.3%) of the participants were classified into the medium category of wealth status. In comparison, 18.7% were categorized as rich, with about 15% in the poor class. The research results revealed that most participants (68%) were single or never married, and 27% were married. Most of the respondents (62.5%) live in rural areas and 37.5% were in Ghana's urban areas. More than half of the respondents (67.5%) were unemployed and 32.5% were employed.

**Table 3.** Socioeconomic and demographic characteristics of the study population.

Variables	Description	n	Frequency (%)
Sex	Male	266	66.5
	Female	134	33.5
Age (years)	18–24	78	19.5
	25–35	237	59.3
	36–40	57	14.2
	40 and above	28	7.0
Religious affiliation	Christianity	323	80.8
	Islamic	47	11.8
	Traditionalist	30	7.4
Highest level of education	University	260	65.0
	Senior High School	97	24.3
	Junior High School	43	10.7
Wealth status	Poor	60	15.0
	Middle	265	66.3
	Rich	75	18.8
Marital status	Married	110	27.0
	Single	272	68.0
	Divorced	18	5.0
Type of residence	Rural	250	62.5
	Urban	150	37.5
Work status	Employed	101	25.3
	Unemployed	299	74.8
Ever heard of the COVID-19 vaccine	Yes	375	92.75
	No	25	6.25
Taken COVID-19 vaccine	Yes	13	4.5
	No	387	96.75
Categories of vaccine hesitancy	No vaccine hesitancy	91	22.8
	Refusers	70	17.5
	Acceptors with doubt	92	23.0
	Delayers	147	36.8
Total		400	100.0
COVID-19, coronavirus disease 2019.			



### *Knowledge about COVID-19 vaccine administration*

Participants were asked whether they had heard about the administration of the COVID-19 vaccination in Ghana. The results revealed that most respondents (92.75%) have heard about the CVV. About 6.25% of the participants said they had not heard about the vaccine administration. The questionnaire was adapted from the study of Acheampong *et al.*<sup>22</sup>

### *Categories of VH*

The researchers asked the participants whether they hesitated, delayed, refused, or accepted the vaccine with doubt to analyze VH levels among the respondents. Out of the 400 respondents, most (36.8%) indicated rejecting the vaccine. About 23% of the respondents were very optimistic that they would delay before receiving the vaccine, while 17.5% would accept the vaccine with doubt. The results also show that 22.8% responded to No VH.

### *Ever-taken COVID-19 vaccine*

Participants were asked whether they had received the CVV currently being administered in Ghana. The study indicates that less than 5% of the participants have so far received the CVV. This shows most Ghanaian have so far not taken the vaccine. Most respondents mentioned either waiting or refusing to take the vaccine.

### *Participant socioeconomic and demographic characteristics and VH*

Table 4 provides VH factors with the reference group for comparative analysis of ‘no vaccine hesitancy’ by the multinomial logistics regression model. The study revealed that the male respondents were considerably more likely to accept doubts with an adjusted odds ratio (AOR) of 1.048 [95% confidence interval (CI): 0.532–2.063]. Participants aged 36–40 years had a critically higher AOR of refusers of the CVV with an AOR of 1.960 (95% CI: 0.555–6.919). Similarly, participants between the ages of 25 and 35 also have a higher percentage of refusing the vaccine. The respondents’ religious affiliation revealed that most Christians would refuse the CVV more than Muslims, with an AOR of 1.641 (95% CI: 0.529–5.096) and an AOR of 1.452 (95% CI:

0.384–5.486), respectively. Respondents with a university educational background had the highest vaccine refusal rate with an AOR of 2.11 (95% CI: 0.870–5.121). Participants with poor wealth status also had a high OR than those categorized under the middle-class group of acceptance with doubt of the vaccine. The poor wealth status group’s OR was 1.333 (95% CI: 0.454–3.918), and the middle class was very close with an AOR of 1.322 (95% CI: 0.563–3.105). The researchers also deduced that there was no significant relationship between the refusers rate and poor classification of wealth status. Results from the study’s multi-logistics regression show that the type of residence, in this case, rural settlers, had a higher AOR of 1.226 (95% CI: 0.665–2.261) of delaying for some time before they took the CVV. Single or unmarried participants also had a greater odds ratio of 1.911 (95% CI: 0.797–4.583) of acceptors with doubts than those married with an AOR of 1.145 (95% CI: 0.342–3.837). The research findings show that the unemployed had a significant AOR of 1.385 (95% CI: 0.674–2.845), receiving the CVV with doubt.

### *Reasons for VH*

To analyze the hesitancy and refusal of the CVV rate in Ghanaians, we categorized the various determinants into three categories as suggested by WG.

*Contextual influence.* In Table 5, the researchers present the determinants of VH based on contextual influence among Ghanaians from multinomial logistics concerning ‘delayers’. The researchers discovered from the results that ‘no vaccine hesitancy’ had an AOR of 1.108 (95% CI: 0.819–1.500) and ‘Acceptor with doubt’ AOR of 1.325 (95% CI: 0.915–1.919) strongly agreed that there is adequate communication about the administration of the vaccine. However, the ‘refusers’ category had a low odd of 0.927 (95% CI: 0.695–1.236), indicating that the participants strongly disagreed with adequate communication about Ghana’s vaccine administration. The study’s analysis also revealed that the ‘No vaccine-hesitant’ category had a better OR of 1.237 (95% CI: 0.921–1.66), agreeing that they trust the government’s decision to enroll in the vaccination in Ghana. Participants refusing to accept the CVV had a negative or low AOR of 0.877 (95% CI: 1.017–1.864); this implies that they do not trust

**Table 4.** Socioeconomic and demographic characteristics and vaccine hesitancy.

Variables (reference)	Acceptors with doubts	Delayers	Refusers
	AOR 95% CI	AOR 95% CI	AOR 95% CI
Sex (Reference: Female)			
Male	1.048 [0.532–2.063]	1.036 [0.549–1.953]	0.869 [0.491–1.538]
Age in years (Reference: 40 and above)			
18–24	0.946 [0.252–3.544]	0.967 [0.299–3.123]	1.033 [0.294–3.630]
25–35	1.102 [0.328–3.700]	0.955 [0.327–2.794]	1.834 [0.591–5.688]
36–40	1.960 [0.183–3.155]	0.587 [0.161–2.142]	0.759 [0.183–3.155]
Religious affiliation (Reference: Traditionalist)			
Christianity	0.672 [0.233–1.941]	0.995 [0.333–2.970]	1.641 [0.529–5.096]
Islamic	0.350 [0.080–1.524]	0.827 [0.216–3.160]	1.452 [0.384–5.486]
Education (Reference: Junior High School)			
University	1.625 [0.558–4.730]	1.103 [0.447–2.726]	2.111* [0.870–5.121]
Senior High School	1.523 [0.483–4.810]	0.898 [0.334–2.413]	0.963 [0.358–2.592]
Wealth status (Reference: Rich)			
Poor	1.333* [0.454–3.918]	0.530 [0.176–1.592]	0.782 [0.314–1.951]
Middle	1.322* [0.563–3.105]	1.153 [0.539–2.468]	0.965 [0.481–1.936]
Marital status (Reference: Divorced)			
Married	1.145 [0.342–3.837]	0.903 [0.325–2.507]	0.577 [0.220–1.515]
Single	1.911 [0.797–4.583]	0.995 [0.478–2.075]	0.760 [0.394–1.469]
Type of residence (Urban)			
Rural	1.035 [0.539–1.987]	1.226* [0.665–2.261]	1.042 [0.600–1.809]

AOR, adjusted odds ratio; CI, confidence interval.  
Note: \*implies a 1% significance level.

the government’s decision about rolling the vaccine in the country.

Furthermore, the researchers wanted to determine if the participants believed the vaccine administration was politically influenced. The study indicated that those refusing to take the CVV had the highest AOR of 1.027 (95% CI: 0.811–1.299), indicating that these participants perceived that the vaccine administration was politically influenced. The researchers also investigated whether the participants trusted the

pharmaceutical industry to produce the vaccine. ‘No vaccine-hesitant’ had the highest odds ratio of 1.137 (95% CI: 0.831–1.557), agreeing that they trust the pharmaceutical industry producing the vaccine.

*Individual and group influences.* Table 6 show the results of multinomial logistics of the demographic and socioeconomic variables of participants’ hesitancy based on individual and group influence, with ‘Acceptors with doubt’ used as the reference group. The analysis results uncovered



**Table 5.** Vaccine hesitancy based on contextual influence.

Contextual influence Variables	No vaccine hesitancy		Acceptor with doubt		Refusers	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Adequate communication about the administration of the vaccine	1.108	(0.819–1.500)	1.325	(0.915–1.919)	0.927	(0.695–1.236)
Trust in government decision in enrolling the vaccination in Ghana	1.237	(0.921–1.661)	1.162	(0.829–1.629)	1.377	(1.017–1.864)
Event from the past has discouraged me from taking the vaccine	0.845	(0.562–1.272)	1.079	(0.695–1.676)	0.948	(0.635–1.414)
Administration of the vaccine is politically influenced	1.005	(0.790–1.278)	1.025	(0.782–1.342)	1.027	(0.811–1.299)
Too much time to be spent taking the vaccine	1.038	(0.825–1.307)	1.056	(0.817–1.366)	1.051	(0.840–1.315)
Trust the pharmaceutical industry producing the vaccine	1.137	(0.831–1.557)	0.988	(0.697–1.401)	1.017	(0.745–1.387)

AOR, adjusted odds ratio; CI, confidence interval.

**Table 6.** Vaccine hesitancy based on individual and group influences.

Individual and group influences Variables	No vaccine hesitancy		Delayers		Refusers	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Better ways to stop the spread of COVID-19 than vaccination	0.958	(0.660–1.390)	1.065	(0.723–1.568)	1.286	(0.882–1.876)
Vaccines are safe for myself, my family, and my country	1.320	(0.874–1.994)	1.254	(0.812–1.935)	1.558	(1.048–2.316)
Fear of taking the vaccine	1.370	(0.945–1.985)	0.802	(0.543–1.184)	1.319	(0.912–1.907)
Vaccine benefits, in general, are more extensive than their risk	1.634	(1.030–2.593)	1.012	(0.640–1.599)	0.837	(0.547–1.279)
Feel social pressure to get the vaccine	1.146	(0.878–1.496)	1.229	(0.931–1.622)	1.066	(0.823–1.380)

AOR, adjusted odds ratio; CI, confidence interval; COVID-19, coronavirus disease 2019.

that the ‘Refuser’ category had the highest AOR of 1.286 (95% CI: 0.882–1.876), agreeing that there are better ways to stop coronavirus spread than vaccination. This analysis indicates that most Ghanaians will refuse to take the vaccine because they perceive that there are other ways to prevent the spread of CVV. An exciting revelation from the study shows that all the reference categories had a significant positive relationship by agreeing with the statement that the vaccines are safe for themselves, family, and their country. The study’s findings indicate a strong relationship with an

AOR of 1.370 (95% CI: 0.945–1.985) for the ‘no vaccine hesitancy’ category agrees that they do not keep any fear of taking the vaccine. This indicates that ‘no vaccine hesitancy’ will take the CVV without fear. However, the researchers observed that the ‘delayers’ category had a lower AOR of 0.802 (95% CI: 0.543–1.184) regarding fear of taking the vaccine.

The research indicates that the ‘no vaccine hesitancy’ category had the highest AOR of 1.634 (95% CI: 1.030–2.593), agreeing that vaccine

**Table 7.** Vaccine hesitancy based on vaccination-specific issues.

Vaccination specific issues Variables	No vaccine hesitancy		Acceptors with doubt		Delayers	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Trust in the mode of administration of the vaccine	1.076	[0.877–1.319]	1.222	[0.976–1.531]	0.096	[0.301–1.570]
Confidence in the system for tracking the adverse effect of the vaccine	0.807	[0.564–1.154]	0.648	[0.435–0.967]	0.759	[0.523–1.103]
Easy access to the immunization center for vaccination	0.947	[0.725–1.236]	1.178	[0.845–1.642]	0.911	[0.677–1.224]
Health professionals recommend that I receive the vaccine	1.275	[0.892–1.821]	1.162	[0.784–1.722]	1.387	[0.926–2.078]

AOR, adjusted odds ratio; CI, confidence interval.

benefits are more significant than risk. This indicates that the ‘no vaccine hesitancy’ category supports the notion that vaccine benefits, in general, are more critical than their associated risk. Regarding social pressure to get the vaccine, delayers have a significant AOR of 1.229 (95% CI: 0.931–1.622).

*Vaccination-specific issues.* From Table 7, the researchers evaluated VH based on vaccination-specific issues, with refusers used as the reference group. The study’s analysis shows that ‘delayers’ had a low AOR of 0.096 (95% CI: 0.301–1.570), indicating these participants do not trust the vaccine’s administration mode in Ghana. The researchers noticed that the ‘No VH’ category had the highest odd of agreed values from the analysis. Table 7 shows that all the various categories had a significant negative relation and strongly disagreed that they have confidence in the system for tracking the vaccine’s adverse effects. Also, from the results, those accepting the vaccine, without doubt, had a high odds ratio of 1.178 (95% CI: 0.845–1.642), confirming that these participants can easily access the immunization center for vaccination. However, ‘Delayers’ had a low odd ratio of 0.911 (95% CI: 0.677–1.224), indicating that they cannot get easy access to the immunization center for vaccination. Moreover, delayers categories had the lowest AOR of 0.911 (95% CI: 0.677–1.224) based on easy access to the immunization center for vaccination.

### Discussion

The researchers analyzed the socioeconomic and demographic characteristics influencing the hesitancy and refusal of CVV in Ghana. Again, the researchers reported the reasons for VH and refusal among respondents based on the WHO WG’s proposed determinants.<sup>4</sup>

#### *Participant socioeconomic and demographic characteristics and VH*

The research results show that most respondents (92.75%) have heard about CVV. Most of the respondents (36.8%) indicated rejecting the CVV, which is in unison with the research.<sup>22</sup> About 23% of the respondents were very optimistic that they would delay before receiving the vaccine, while 17.5% would accept the vaccine with doubt. The results also show that 22.8% responded to No VH. The study indicates that less than 5% of the participants have so far received the CVV. This shows most Ghanaian have so far not taken the vaccine. Male respondents dominated the research, and the researchers also found a positive association between the male sex and acceptance of CCV among participants. Studies conducted by Zhou *et al.*,<sup>10</sup> Acheampong *et al.*,<sup>22</sup> and Brackstone *et al.*<sup>23</sup> found similar results among Ghanaian citizens. However, the participants’ demographic features show that most of the respondents are in their youthful stage, and their ages range between 25 and 35 years, which is in line with previous

studies.<sup>27,28</sup> However, this research findings show that participants aged between 36 and 40 years had a higher AOR of refusers of the CVV in Ghana. Lazarus *et al.* found associations between age and acceptance of vaccines. Similarly, several extant studies have also indicated that age and sex affect VH in Ghana.<sup>29–31</sup>

Most of the respondents' religious affiliation was Christianity, and the results revealed that most Christians would refuse to accept the CVV compared with Muslims.<sup>32</sup> It was reported that Nigeria's polio vaccination scheme was refuted due to various religious leaders' misconceptions. Also, Lazarus *et al.*<sup>33</sup> found that Muslims are much less likely to agree on vaccines' safety and efficacy, especially in comparison with Atheists in a European study. In a recent study in Ghana, Botwe *et al.*<sup>31</sup> revealed that some respondents believe that they did not receive the CVV due to their religious beliefs.

Interestingly, this research found a positive association between refusing, accepting with doubt, and delaying taking the vaccine and educational level. Furthermore, the study revealed that respondents with university educational backgrounds had the highest refusal rate of the CVV in Ghana. This outcome is consistent with the study by Acheampong *et al.*,<sup>22</sup> who enunciated that increased educational attainment levels are most likely to drive CVV uptake in Ghana. Moreover, Shapiro *et al.*<sup>34</sup> reported that the relationship between academic level and vaccine reluctance varies in different situations. A Special Eurobarometer report shows that higher education people also perceive the risk that diseases and vaccines are preventable and effective.<sup>35</sup>

In contrast to this outcome, Mohd Azizi *et al.*<sup>36</sup> revealed that parents with high education were more likely to be delayers or refusers than non-hesitant in Malaysia. The reason to support their work was that participants with higher educational backgrounds have more access to search for vaccine information, thereby exposing themselves to vaccines' negative news. Therefore, participants with a high level of education may be high refusers of the vaccine. This study suggests that public health organizations should invest in positive social networking, such as social media campaigns, to improve the possibility of people receiving encouraged and accurate messages from

vaccinators. This study also supported our findings.<sup>37</sup>

An important finding from this research is that most participants were classified into the medium category of wealth status. The results show a positive association between the poor and the middle class in accepting the CVV with doubt. This result supports Bertonecello *et al.*,<sup>16</sup> whose research has shown that economic difficulties reflect a predictor of vaccine hesitation when no link between financial distress or refusal of vaccines has been established. Basheer *et al.*<sup>38</sup> also concluded in their studies that it is essential to understand that the vaccination status wealth disparity is minimal for complete vaccination in Ghana compared with Nigeria.

Surprisingly, our study results indicate that rural settlers had a higher delay rate before taking the CVV than urban settlers. The relationship between rural dwellers and the rate of vaccine refusal is quite interesting. We noticed that rural settlers had a significantly higher chance of refusing to take the vaccine faster than urban dwellers. The link between urban areas and complete vaccination in literary works has not been consistent.<sup>11,39</sup> A possible explanation may be the survey's different settings. Also, vaccination levels have been linked to remote areas; the mean vaccination rate decreases according to the urbanization of communities, with the lowest vaccine levels in major cities.<sup>40</sup> Overall, the researchers also recognize that single or never-married respondents had a greater chance of accepting the vaccine with doubt than the married participants in this survey. A study in Brazil indicated that a group of single parents with the lowest risk of vaccination and those with the highest response rate were less likely to accept vaccination.<sup>41</sup>

It is important to note that the findings suggested that unemployed people had high odds of receiving the vaccine with doubt in Ghana. Similarly, previous studies have indicated that unemployed individuals are hesitant to accept the virus from various geographical areas. For instance, studies by Moy<sup>36</sup> for Malaysia, Browne *et al.*<sup>41</sup> for Australia, and Brackstone *et al.*<sup>23</sup> for Ghana. This survey has some limitations. First, the questionnaires were self-administered, and some questions could have been misunderstood. Second, there may be a particular selection bias because of

our sampling. This research used the purposeful sampling technique, an unlikely sampling method, which reduces the extent to which the results can be generalized among Ghanaian participants. Notwithstanding these limitations, this article highlights the socioeconomic and demographic characteristics of CVV hesitancy and refusal in Ghana to reduce VH among Ghanaians.

#### *Determinants of VH and refusal*

The researchers also investigated the prevalence of coronavirus hesitancy among Ghanaians. The WHO WG proposed a determinants matrix arranged in three dimensions: individual and group influences, contextual influences, and vaccine-specific issues. Contextual influences are primarily concerned with factors arising from vaccination refusals by people's historical, social and cultural, environmental, medical system, political, and socioeconomic variables. The researchers reported that in Ghana, those accepting the CVV with doubt agreed that there is adequate communication about the vaccine's administration in Ghana. However, those refusing to take the CVV vaccine strongly agreed that there is inadequate information about the vaccine administration. The researchers suggest that Ghana's Government can use various new portals, social media, radio stations, and news portals to create awareness and educate the citizens about taking the vaccine.

Another significant finding from the research is that participants who are not hesitant to take the vaccine trust that Ghana's Government is rolling out the COVID-19 virus.<sup>24</sup> It reported that vaccine delivery and confidence in the government were significantly associated with VH in China. Also, the survey assessment shows that participants not hesitant to take the vaccine strongly agree that they trust the pharmaceutical industry in producing it. In another argument, those refusing to take the vaccine strongly perceive that they do not trust the pharmaceutical industry making the vaccine. Wallace *et al.*<sup>17</sup> asserted that virtually all participants responded by responding to their surveys with a strong confidence level in healthcare providers and government-specific vaccination schedules in Ghana.

Moreover, the study provides evidence of VH among Ghanaians by analyzing the individual

and group influence determinants. Group influences emanate from experience with vaccination, individual beliefs, attitudes, and prevention. Factors that constitute individual and group influencers can also arise due to healthcare providers' trust and personal experience, knowledge, and awareness about vaccines and the risk and benefits associated with their vaccine. In Ghana, participants refusing to take the CVV strongly agreed that there are better ways to stop the spread of the coronavirus than the vaccine. Chakamba<sup>42</sup> released a report indicating that in the 15 African countries where the survey was conducted, almost all respondents believe that CVV is less safe than other vaccines. Interestingly all participants agreed that the vaccine is safe for themselves, their family, and their country. This result is inconsistent with the study by Agyekum *et al.*<sup>43</sup> Participants delaying accepting the CVV agreed that they fear taking the vaccine. There was a strong positive relationship with all the categories regarding social pressure to get the vaccine. This shows that most participants agreed they feel social pressure to get the vaccine.

We analyzed VH among the respondents, reporting on vaccine-specific issues, with refusers being the reference group. Vaccination with specific issues about introducing new vaccine formulation, mode of vaccine administration, vaccine design, delivery method, reliability and source, vaccine schedule, vaccine costs, and healthcare professionals' roles. The analysis demonstrates that participants delaying the CVV intake in Ghana do not trust the vaccines being administered. This survey discovered an inverse relationship between confidence in the vaccine program design and refusers' design. This outcome implies that citizens refusing to take the vaccine do not trust the vaccination program in Ghana. An intriguing analysis shows that all the various categories had a significant negative relation and strongly agreed that they have no confidence in the system for tracking the adverse effect of the CVV. A recent report in Ghana about CVV was that about 1050 Ghanaians had side effects after the COVID-19 vaccination.<sup>44</sup> This suggests that health professionals' role in every vaccination program is vital. Our analysis found that all the categories agreed that health professionals recommend receiving the vaccine in Ghana.

## Conclusion and recommendations

Ghana is not an exception from countries encountering VH issues, which is an unpredictable phenomenon in the global context. Therefore, VH should be investigated to help authorities understand and monitor the challenges citizens face in being hesitant to take vaccines. This study's results suggest a high awareness of the coronavirus vaccination in Ghana. Interestingly, male participants with higher educational backgrounds, low economic class category, rural settlers, unmarried individuals, and unemployed people have higher odds of being vaccine hesitant or refusers. In this study, trust in the vaccine administration, confidence, and uneasy access to immunization centers were listed as reasons for vaccine refusal in Ghana. The survey also shows that most Ghanaians refuse to receive the CVV because they do not trust the system to track the vaccine's side or adverse effects. The survey analysis highlights the need to address VH, especially during this current CVV. The government can use social and other platforms to effectively and transparently provide relevant information regarding the vaccine's total benefits and risks.

Based on the findings of this study, the researchers make the following recommendations. First, health experts and the government communicate to the citizens in Ghana about the vaccine's side effects. Disclose information on the COVID-19 vaccine from renowned and credible professional health workers. Information about the CVV can be disseminated through all available platforms, including social media accounts, newspapers, radio stations, and blog posts. Second, measures should be put in place by the government and the vaccination team in Ghana to make vaccination appointments easy and accessible to partner pharmacies and vaccination sites.

Furthermore, there should be a clear focus on communicating truthful information about vaccines and using behavioral science strategies to influence behavior, not distributing vaccine myths. Third, enhance vaccination acceptance and stimulate endorsement by influencers and leading spokespersons. Fourth, there is the need to highlight the personal stories of persons who had COVID-19, which affected them and their families. Finally, strategies need to be provided for rural areas to have easy access to immunization centers. Healthcare should provide more information about the need to receive the vaccine in Ghana.

## Limitations and future directions

The sample size explored in this analysis came from a single country; hence the study can present findings that cannot be used for a general conclusion. Accordingly, future studies will increase the sample size and study area by evaluating VH among some selected countries in West Africa. Moreover, the variables explored can be improved. For instance, future studies can examine the perception of health workers toward the administration of CVV among citizens.

## Declarations

### *Ethics approval and consent to participate*

This article does not contain any studies with human participants or animals performed by any of the authors. All authors consent to the content of this article for publication.

### *Consent for publication*

All authors have read and agreed to the published version of this article.

### *Author contributions*

**Agyemang Kwasi Sampene:** Conceptualization; Formal analysis.

**Cai Li:** Investigation; Project administration; Supervision.

**Fredrick Oteng Agyeman:** Data curation; Software.

**Robert Brenya:** Methodology; Writing – review & editing.

### *Acknowledgements*

Philosophy and Social Sciences Excellent Innovation Team Construction foundation of Jiangsu province (SJSZ2020-20).

### *Funding*

The authors received no financial support for the research, authorship, and/or publication of this article.

### *Competing interests*

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### *Availability of data and materials*

All data for the study are available and will be supplied upon request.



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