Factors Influencing Intentions and Acceptance of COVID-19 Vaccines in Ghana

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Abstract
In this study, we examined the perceptions of Ghanaians about COVID-19 vaccines and the factors that may influence their intentions to vaccinate. We conducted an online survey to collect data from 331 Ghanaians, between 22nd March 2021 and 15th April 2021. Descriptive multivariate analyses were performed using STATA version 13. The findings revealed that 45.7% of respondents were reluctant to vaccinate even if the vaccines were available for free. Age, region and residential area were significant predictors of intention to vaccinate. Misinformation, side effects and lack of trust were among some reasons cited for not intending to vaccinate. However, some people were likely to vaccinate when they were encouraged by a trusted community leader. To ensure higher uptake of vaccines, government officials must engage trusted community leaders to increase public education, targeting specific age groups, areas and regions in Ghana.

Keywords*: COVID-19, Vaccination, Intention, Influence of Community Leaders, Public Health*

Introduction

On 12th March 2020, the Ministry of Health reported the first two confirmed cases of the novel coronavirus disease known as COVID-19 (Ministry of Health, 2020). Confirming the first two new cases triggered a government alert to tackle the disease. Immediately, the Government of Ghana introduced some restrictions to curb the disease (Akafia, 2020). Closure of territorial borders and lockdowns were among the measures the government took. The restrictions introduced by the Government of Ghana brought about many hardships to Ghanaians.

In reporting the socio-economic impact of COVID-19 on the Ghanaian economy, Aduhene and Osei-Assibey (2021) disclosed that about 42,000 people lost their jobs during the first two months of the pandemic. In the tourism and hospitality sector of the economy, they reported a total loss of $171 million in the first three months of the pandemic (Annoh, 2020). Asante and Mills (2020) also reported a general increase in the prices of goods and services due to panic buying and a shortage in supply. The impact of the pandemic on children has been enormous.

Nearly one million children below age one missed routine essential health services (UNICEF, 2021). Also, 24.1% of children between six months and 14 years of age living in households were reported to have had fewer meals than before the pandemic (UNICEF, 2021).

Despite the setbacks of COVID-19, the introduction of vaccines is seen to restore life to normalcy. On 24th February 2021, Ghana became the first country to receive COVID-19 vaccine doses under the COVID-19 Vaccines Global Access (COVAX) programme (WHO, 2021). Shortly after that, a national COVID-19 vaccination programme was rolled out, with the President of Ghana taking the first injection on live television (WHO, 2021). However, there are reports of incidents where people have rejected vaccination, and it was anticipated that the same might happen to COVID-19 vaccines.

In Nigeria, unfounded rumours spearheaded mostly by state politicians that a polio vaccine was contaminated with anti-fertility agents led to a statewide boycott of a polio vaccination exercise for at least 15 months (Aylward & Heymann, 2005). This significantly increased the polio caseload from 202 in 2002 to 1143 in 2006 (Aylward & Heymann, 2005).

A similar incident happened in Kenya where a religious leader led an anti-vaccination campaign from the pulpit, claiming that the polio vaccine deployed in the country was infected with HIV and meant to exterminate certain communities (Hydarav et al., 2021). Although this anti-vaccine campaign did not lead to a reintroduction of polio, it slowed down the vaccination exercise (Hydarav et al., 2021).

Recent studies have revealed that whereas the majority agree to vaccinate against COVID-19, several people, ranging from 6% to 25%, are hesitant to take the vaccine (Freeman et al., 2020; Dodd et al., 2021; Faasse & Newby, 2020; Malik et al., 2020; Neumann et al., 2020). One main factor that has been identified for dissuading people from accepting the COVID-19 vaccine is the fear of contracting an infection. For example, a recent study in some Arab countries disclosed that, respectively, 27.7% and 23.4% believed COVID-19 vaccines are intended to inject microchips into individuals and cause infertility (Sallam, 2021). A similar study in France also disclosed that people rejected the COVID-19 vaccine because they underestimated the impact of the disease and perceived that they were not at risk (Schwarzinger, 2021).

In Ghana, a study by Agyekum et al. (2020) conducted among health workers revealed concerns about the safety of vaccines and the side effects. Brackstone et al. (2022) showed that inadequate vaccine-related information and concerns over vaccine safety influence vaccine hesitancy in Ghana. Atinga et al. (2020) have also mentioned that vaccine nationalism among developed countries was the factor that led to the inadequate supply of vaccines in Ghana. However, they acknowledge the role of political actors in dispelling misperceptions about vaccine safety among Ghanaians. Equally, in Ghana, Alhassan et al. (2021) found that unwillingness to participate in a COVID-19 vaccine trial and take the vaccine included fear, safety concerns, lack of trust in state institutions, and spiritual and religious beliefs.

Our study has come at a time when vaccination is still ongoing in the country, with reported instances of low public acceptance (WHO, 2021). The debate on why and what may be influencing intentions and uptake of the COVID-19 vaccine in the country is still pertinent to

inform strategies and policies on the uptake of vaccines. Hence, this research aims to investigate what influences the intentions and uptake of the COVID-19 vaccine in Ghana.

Methods

Study setting

Ghana is in West Africa and bounded on the North by Burkina Faso, the West by Côte d'Ivoire, the East by Togo and the South by the Gulf of Guinea. The country's Gross National Income per capita in 2021 was 2280 (World Bank, 2021). The country has16 administrative regions. Each of these regions has a health directorate that implements health-related government policies.

In terms of health facilities, there are about 1,600 facilities in the country, most of which are owned and operated by the government. The distribution of these facilities depicts that the Ashanti Region has the highest number of health facilities (530), followed by the Greater Accra (438) and Eastern (331) regions. The least number of health facilities are found in the Ahafo (44) and North East (36) regions (Sasu, 2020).

Study design

Data was gathered through a cross-sectional online survey among adults. The philosophical assumptions underpinning mixed-method research design were employed to collect and analyze responses from respondents of the study.

Theoretical Model

The Health Belief Model (HBM) (Rosenstock, 1974; Rosenstock, Strecher & Becker, 1988) guided the content of the current survey. This model has three components: modifying variables, individual perceptions, and deciding to act. The modifying variables consist of the demographic characteristics of an individual. The individual perceptions involve perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. Apart from the three components, another aspect of the model that explains behavioural change is a cue to action.

In the current study, the modifying factors were the respondent's background characteristics, the individual perception indexed as 'intention', judge severity, content about benefits, and the ability of the respondent to overcome barriers to have the absolute intention to accept the COVID-19 vaccine. Besides, on cue to action, respondents' observations on how significant trusted leaders are presenting themselves for the vaccine may influence their (respondents) decision to also avail themselves to be vaccinated. The model was adapted to examine factors influencing the intention and likelihood to take up COVID-19 vaccine in the country.

Study variables

Two main outcome variables were considered in the study. They included an intention to vaccinate and a cue to take action to vaccinate. Both outcome variables were captured as dummy variables (intention to vaccinate as '1=yes' and '0=no'; and cue to action as '1=yes' and '0=no'). To measure 'intention to vaccinate,' respondents were asked, 'Do you intend to vaccinate against COVID-19 when the vaccine is available for free in your community?' Then cue to take action to vaccinate was examined with the question, 'Will you vaccinate for

COVID-19 if your most trusted community leader in the above category is vaccinated against COVID-19?' The confounders included age, marital status, education, region, area, and religion. The variable 'region' was recorded into 10 regions to conform with previous studies' categorizations since the six additional new regions were recently carved from the existing regions. Categorical details of the other potential confounders are in Table 3 and Table 4. The choice of each set of potential confounders was guided by a review of related literature and how vital each confounder is in explaining their associations with the outcome variables.

Data collection

Our survey aimed at reaching a large portion of adult Ghanaians within the shortest time without having direct contact with them as a precautionary measure against contracting COVID-19. We applied a convenient sampling method to recruit Ghanaians above the age of 18 for the study. COVID-19 witnessed a surge in online media usage to conduct surveys (De Man et al., 2022). Equally, we used social media platforms (WhatsApp and Facebook) to post a link to the questionnaire hosted by Google. These online media were appropriate in terms of helping to reach a wider number of respondents across the country. Individuals who filled out the questionnaire were also requested to forward the link to their social networks and groups to reach more respondents. Although selection bias is bound to occur when data is collected online, we found that collecting data online enabled us to reach the "literate population" who possessed the potential to influence vaccine updates among the "illiterate population" (Acheampong et al., 2021).

Data collection was undertaken from 22nd March 2021 to 15th April 2021, after vaccines arrived in Ghana and were distributed to frontline workers. Data collection ceased when new responses were not forthcoming, even after reminders were sent. The sample size was not predetermined but only arrived when the response rate declined. Three hundred and thirty-one (331) respondents were recruited through a convenient sampling online survey.

Data analysis

In the analysis of data, frequencies, proportions, and percentages were initially generated to assess the distribution of various categories of variables. The linkage between the dependent and independent variables was further appraised employing the Chi-square test of independent associations. In addition, logistic regression was used to study associations of categories of variables and the outcome variables. Independent variables that were statistically significant in the Chi-square test and those variables that were deemed to be of social relevance (although not statistically significant) were included in the logistic regression. The outcome variables were independently assessed using logistic regression by controlling for a similar set of potential confounders. For 'intention to vaccinate,' age, marital status, region, and area were considered, while for 'cue to action,' age, education, marital status, region, and religion were adjusted for the regression analysis. All statistically significant associations were assessed with $p < 0.05$. Data processing and analysis were done using Stata version 13.

Ethics

The study procedures were performed following the tenants of the Helsinki Declaration (World Medical Association, 2013). On the online questionnaire, each respondent was well informed about the objective of the study. Their anonymity and confidentiality in answering

the questionnaire were assured. Participants had the option to skip some or answer all questions at their will. A question was asked to seek their consent to proceed to the study questions. Since the study posed no identifiable risk to the respondents, no institutional review board (IRB) was approached to give us ethical clearance.

Results

Demographics

Three hundred and thirty-one (331) respondents were recruited. The males were 56% whilst the females were 44% (Table 1). The majority of the respondents (61.7%) were between the ages of 18 and 25. Between the ages of 46 and 50 constituted the least number of respondents (1.8%). Most respondents (64.6%) had obtained a bachelor's degree, a diploma, or a basic education certificate (1.5%). Almost seven in ten (69%) were either single or not in any union and 4.3% of them had either separated with their partners or had been divorced. About 31.2% of respondents resided in the Greater Accra Region, while a few lived in the Western Region (1.51%). Besides, most of them (79.6%) lived in urban areas. In terms of religion, 73.1% were Christians. Approximately 46.2% rated their health as 'good', while a few (9.2%) rated their health as 'fair'. The majority (86.5%) said they had no underlying health conditions, whereas 13.5% said they were living with underlying health conditions.

Table 1: Distribution and Chi-square test of independence of background characteristics on intention and cue to action for Covid-19 vaccine

		Intention			**Cue to action**		
Characteristic	**n(%)**	*Yes* *n(%)*	*No* *n(%)*	**p-value**	*Yes* *n(%)*	*No* *n(%)*	**p-value**
Age				0.006**(16.03			0.056*(10.68)
18-25	201(60.73)	116(57.7)	85(42.29)	)	119(59.20	82(40.80)	
26-35	61(18.43)	32(52.46)	29(47.54)		)	26(42.62)	
36-45	24(7.55)	8(32.00)	17(68.00)		35(57.38)	9(36.00)	
46-50	7(2.42)	2(25.00)	6(75.00)		16(64.00)	5(62.50)	
51-60	20(6.04)	5(25.00)	15(75.00)		3(37.50)	15(75.00)	
60+	16(4.83)	6(37.50)	10(62.50)		5(25.00)	8(50.00)	
					8(50.00)		
Sex				0.497(0.46)			0.777(0.08)
Male	182(54.98)	96(52.75)	86(47.25)		101(55.49	81(44.51)	
Female	149(45.02)	73(48.99)	76(51.01)		)	64(42.95)	
					85(57.05)		
Education				0.282(6.36)			0.025**(12.82
No education	13(3.93)	4(30.77)	9(69.23)		8(61.54)	5(38.46)	)
Primary	14(4.23)	4(28.57)	10(71.43)		4(28.57)	10(71.43)	
JHS/SHS	54(16.31)	31(57.41)	23(42.59)		38(70.37)	16(29.63)	
Diploma/Degr	210(63.44)	109(51.90	101(48.10		109(51.90	101(48.10	
ee	21(6.34)	)	)		)	)	
Masters	19(5.74)	10(47.62)	11(52.38)		15(71.43)	6(28.57)	
Doctorate		11(57.89)	8(42.11)		12(63.16)	7(36.84)	
Marital status				0.007**(11.99			0.082*(6.71)
Never married	226(68.28)	130(57.52	96(42.48)	)	135(59.73	91(40.27)	
Currently	71(21.45)	)	45(63.38)		)	33(46.48)	
married	20(6.04)	26(36.62)	12(60.00)		38(53.52)	11(55.00)	
Living with	14(4.23)	8(40.00)	9(64.29)		9(45.00)	10(71.43)	
partner		5(35.71)			4(28.57)		
Separated/div							
orced							
Region				0.489(8.66)			0.142(13.47)
Greater Accra	104(31.42)	45(43.27)	59(56.73)		52(50.00)	52(50.00)	
Ashanti	64(19.34)	35(54.69)	29(45.31)		36(56.25)	28(43.75)	
Eastern	22(6.65)	12(54.55)	10(45.45)		9(40.91)	13(59.09)	

Western	5(1.51)	3(60.00)	2(40.00)		3(60.00)	2(40.00)	
Central	6(1.81)	5(83.33)	1(16.67)		5(83.33)	1(16.67)	
Northern	36(10.88)	21(58.33)	15(41.67)		23(63.89)	13(36.11)	
Volta	7(2.11)	5(71.43)	2(28.57)		5(71.43)	2(28.57)	
Brong Ahafo	11(3.32)	7(63.64)	4(36.36)		10(90.91)	1(9.09)	
Upper West	53(16.01)	25(47.17)	28(52.83)		32(60.38)	21(39.62)	
Upper East	23(695)	11(47.83)	12(52.17)		11(47.83)	12(52.17)	
Area				0.459(0.54)			0.299(1.08)
Urban	263(79.46)	137(52.09	126(47.91		144(54.75	119(45.45	
Rural	68(20.54)	)	)		)	)	
		32(47.06)	36(52.94)		42(61.76)	26(38.24)	
Religion				0.883(0.25)			0.244(2.82)
Christianity	236(71.30)	122(51.69	144(48.31		128(54.24	108(45.76	
Islam	82(24.77)	)	)		)	)	
Traditional	13(3.93)	40(48.78)	42(51.22)		48(58.54)	34(41.46)	
		7(53.85)	6(46.15)		10(76.92)	3(23.08)	
Healthy condition				0.159(1.98)			0.760(0.09)
Yes	48(14.50)	20(41.67)	28(58.33)		26(54.17)	22(45.83)	
No	283(85.50)	149(52.65	134(47.35		160(56.54	123(43.46	
		)	)		)	)	

**-p<0.10; **-p<0.05; n-sub sample; %-percentage; JSH-Junior High School; SHS-Senior High School*

Health beliefs

Overall, perceived susceptibility to COVID-19 was relatively high among respondents. Fifty-seven per cent of respondents agreed that they had a higher chance of contracting COVID-19 due to the nature of their work, whereas 28.4% disagreed (Table not shown). Besides, 57.2% said they were afraid of getting COVID-19. However, 29.4% disagreed with the same question. Also, 50.1% believed they would be very sick if they became ill due to COVID-19, and 50.3% indicated they were worried about getting COVID-19, whereas 34% disagreed. Meanwhile, 41% agreed with the possibility of getting COVID-19, whereas 43.1% disagreed.

Perceived benefits were also high among respondents; 57% agreed that COVID-19 vaccines were beneficial. Sixty per cent agreed vaccination would decrease their chances of getting COVID-19 or its complications. Respondents also reported higher perceived barriers to vaccination, with 82.3% of them claiming that COVID-19 vaccines were fake or faulty. Besides, 81.1% were worried about the safety of the COVID-19 vaccine, with 69.2% reporting that they were concerned about the efficacy of the vaccine. Sixty-eight per cent of participants were worried about the side effects of the vaccine.

The majority (74%) said they would get the COVID-19 vaccine if they were provided with adequate information. However, a significant number (62.8%) disagreed that they would take the COVID-19 vaccine if they tested positive. Only 35.2% agreed they would take the COVID-19 vaccine if it led to the denial of opportunities such as travelling and using certain public spaces, whereas 47.9% were not concerned about losing opportunities.

Also, only 41.4% said they would vaccinate when many people took the vaccine; however, 40.2% disagreed with the same question. Among community leaders, the majority (56.3%) of the respondents were more likely to trust religious leaders and less likely to trust politicians (77.1%) when they spread COVID-19 messages. Further, 55% of respondents were willing to take the vaccine if one of the community leaders they trusted spoke to them about the COVID-19 vaccine. Also, 45.4% were less likely to vaccinate if a close friend or a family member took a vaccine.

Bivariate distributions and factors associated with intention, and cue to action for vaccine

Table 1 shows results on distributions of intention and cue to action (most trusted community leader) to vaccinate against COVID-19. Also, bivariate associations were ascertained. Age and marital status had a statistically significant association with the intention to go for the COVID-19 vaccine. Slightly half of the respondents aged 18-25 indicated their intention for the COVID-19 vaccine. The least age categories were 46-50 (25%) and 51-60 (25%). About half of the males and less than half of the females had a positive intention for the vaccine. Proportionally, more than half of the respondents with doctorate degrees and those who were neither married nor in a union showed interest in the COVID-19 vaccine. In the country, more respondents located in the Northern Region (58%) and those in urban areas (52%) had an intention for the vaccine. Also, a higher number of Christians (52%) and respondents with no underlying health condition (53%) indicated their interest in the COVID-19 vaccine.

Intention to Vaccinate and Reasons for No Intention to Vaccinate

At the time of conducting this study, vaccines had arrived in Ghana and were being distributed to frontline workers (Table not shown). Among survey respondents, 94.2% reported they had not been vaccinated, whereas 5.8% said they had received the first round of vaccine. Those who received the first round of vaccines were doctors, nurses, government officials, and other frontline workers. Among those who had not been vaccinated, 54.3% said they intended to vaccinate when the vaccine was made available in their community for free. In comparison, 45.7% said they would not vaccinate even when the vaccine was made free and accessible to them.

Reasons for not intending to vaccinate were broad among respondents. About 17% had doubts about the efficacy and quality of vaccines brought to Ghana. While 15.1% reported fear of possible side effects, 12% reported a lack of information about vaccines. Surprisingly, 12.5% believed the COVID-19 vaccine was introduced to reduce fertility and eventually reduce the population size of Africa, as they doubted the motive or rationale of vaccine donors. Besides, 7.1% did not trust government officials and their handling of COVID-19 and its vaccines. Another 7.1% did not believe in the existence of COVID-19, while 5.3% believed the vaccine was at a trial stage and, therefore, unsafe for use.

Whereas 6.25% did not have any reason for not intending to vaccinate, 16% had other reasons, such as pregnancy, a strong immune system, use of local herbal medicines, avoiding exposure to COVID-19, and a belief that Jesus Christ would heal them when they became ill with COVID-19. Some also said they had an underlying health condition or they were old, for which reason they did not care if they died of COVID-19.

Logistic regression models for intention to vaccinate against COVID-19

Table 2 consists of two logistic regression models – bivariate and multivariate (full). In the full model, age, region, and area were significant predictors of intention to vaccinate. Respondents of the age groups 36-45, 46-50 and 51-60, who were at odds with vaccination, decreased by 28%, 92% and 79% respectively, compared to those of the age category 18-25 (AOR = 0.32; 95% CI 0.08-1.23, AOR = 0.08; 95% CI 0.01-0.84 and AOR = 0.21; 95% CI 0.04-1.05). Residents of the Central, Northern and Volta regions were more likely about thirteen

times (AOR = 12.59; 95% CI 1.06-148.45), three times (AOR = 3.21; 95% CI 1.13-9.17), and seven times (AOR = 7.26; 95% CI 0.88-59.28) respectively, compared to other residents of Greater Accra, to opt for COVID-19 vaccine. Rural folks had decreased odds of 42% of being vaccinated compared to their urban counterparts (Table 1).

Table 2: Logistic regression models for intention to vaccinate against Covid-19

Characteristic	Model I		Model II	
	OR (95% CI)	p-value	AOR (95% CI)	p-value
Age				
18-25	1		1	
26-35	0.80(0.45-1.44)	0.469	0.79(0.36-1.76)	0.577
36-45	0.34(0.14-0.84)	0.018**	0.32(0.08-1.23)	0.097*
46-50	0.24(0.03-1.24)	0.089*	0.08(0.01-0.84)	0.035**
51-60	0.25(0.08-0.69)	0.009**	0.21(0.04-1.05)	0.058*
60+	0.44(0.15-1.25)	0.125	0.48(0.10-2.24)	0.352
Marital status				
Never married	1		1	
Currently married	0.42(0.24-0.73)	0.002**	0.61(0.23-1.61)	0.325
Living with partner	0.49(0.19-1.25)	0.136	0.67(0.20-2.20)	0.519
Separated/divorced	0.41(0.13-1.26)	0.120	0.70(0.18-2.77)	0.620
Region				
Greater Accra	1		1	
Ashanti	1.58(0.84-2.96)	0.151	1.66(0.83-3.29)	0.146
Eastern	1.57(0.62-3.96)	0.337	1.64(0.61-4.37)	0.326
Western	1.96(0.31-12.26)	0.469	3.33(0.44-25.26)	0.243
Central	6.55(0.73-58.09)	0.091*	12.59(1.06-148.45)	0.044**
Northern	1.83(0.85-3.95)	0.121	3.21(1.13-9.17)	0.029**
Volta	3.27(0.60-17.67)	0.167	7.26(0.88-59.28)	0.064
Brong Ahafo	2.29(0.63-8.32)	0.206	2.96(0.72-12.10)	0.131
Upper West	1.17(0.60-2.27)	0.642	1.75(0.74-4.13)	0.196
Upper East	1.20(0.48-2.97)	0.691	2.08(0.72-6.01)	0.174
Area				
Urban	1		1	
Rural	0.81(0.47-1.39)	0.460	0.581(0.308-1.096)	0.094*

**-p<0.10; **-p<0.05; JSH-Junior High School; SHS-Senior High School*

Concerning cue to action, age, education and marital status exhibited significant associations (Table 2). More than three-fifths of respondents aged 36-45 would vaccinate against COVID-19 if a trusted community member was vaccinated. Minimal proportionate differences were observed for males and females. Approximately seven in ten of the respondents who attained junior high school education (70%) and those with doctorate degrees (71%) would be motivated to vaccinate, relying on a significant cue to action in their community. Most individuals who were single or were not in any union (60%), those in the Brong Ahafo Region (91%), and urban dwellers (55%) would opt for the vaccine if a respected person within their environs was injected with COVID-19 vaccine. Also, more traditionalists (77%) and persons with no apparent health condition (57%) were willing to take the vaccine with a cue to action.

The results of logistic regression for acceptance of the vaccine, if a trusted leader is vaccinated, are presented in Table 3. Age, education, region, and religion were significant predictors of cue to action. Respondents aged 46-50 and 51-60 had lesser odds of 93% (AOR

= 0.07; 95% CI 0.01-0.61) and 91% (AOR 0.09= 0.08; 95% CI 0.02-0.51) respectively of being vaccinated if a trusted community leader got vaccinated.

Moreover, based on a reliable cue to action, respondents with primary education and those with a diploma or degree respectively were 87% (AOR = 13; 95% CI 0.02-0.83) and 92% (AOR = 0.08; 95% CI 0.01-0.42) less likely to be vaccinated compared to those with no education. Additionally, respondents in the Brong Ahafo, Central and Northern regions, respectively, were fifteen times (AOR = 15.12; 95% CI 1.66-137.93), nine times (AOR = 9.29; 95% CI 0.91-94.39), and three times (AOR = 3.04; 95% CI 1.03-9.03) more likely to present themselves for vaccination if a trusted leader in the community was vaccinated. Likewise, respondents of the Traditional Religion were four times (AOR = 4.46; 95% CI 1.02-19.54) more likely to vaccinate against COVID-19 based on evidence that others they revered in society had been vaccinated.

Table 3: Logistic regression models for the cue to action (trusted leaders) to vaccinate against Covid-19

Characteristic	Model I		Model II	
	OR (95% CI)	p-value	AOR (95% CI)	p-value
Age				
18-25	1		1	
26-35	0.927(0.519-1.657)	0.800	0.694(0.301-1.596)	0.390
36-45	1.225(0.516-2.905)	0.645	0.885(0.215-3.645)	0.867
46-50	0.413(0.096-1.778)	0.235	0.065(0.006-0.614)	0.017*
51-60	0.229(0.080-0.656)	0.006*	0.092(0.016-0.507)	0.006*
60+	0.689(0.248-1.910)	0.474	0.340(0.068-0.507)	0.189
Education				
No education	1		1	
Primary	0.250(0.049-1.251)	0.092*	0.132(0.021-0.832)	0.031*
JHS/SHS	1.484(0.420-5.237)	0.539	0.251(0.044-1.408)	0.116
Diploma/Degree	0.674(0.213-2.129)	0.502	0.075(0.013-0.421)	0.003**
Masters	1.562(0.361-6.758)	0.550	0.293(0.040-2.114)	0.224
Doctorate	1.071(0.250-4.591)	0.926	0.358(0.056-2.255)	0.274
Marital status				
Never married	1		1	
Currently married	0.776(0.453-1.327)	0.355	0.717(0.258-1.987)	0.523
Living with partner	0.551(0.219-1.384)	0.205	0.420(0.122-1.436)	0.167
Separated/divorced	0.269(0.082-0.885)	0.031*	0.371(0.085-1.615)	0.187
Region				
Greater Accra	1		1	
Ashanti	1.285(0.687-2.404)	0.431	1.671(0.822-3.395)	0.156
Eastern	0.692(0.272-1.759)	0.440	0.692(0.248-1.924)	0.481
Western	1.500(0.240-9.350)	0.664	2.243(0.280-17.922)	0.446
Central	5.000(0.564-44.283)	0.148	9.292(0.914-94.389)	0.059
Northern	1.769(0.810-3.864)	0.152	3.042(1.025-9.025)	0.045*
Volta	2.500(0.463-13.471)	0.286	4.080(0.542-30.679)	0.175
Brong Ahafo	10.000(1.235-80.950)	0.031*	15.123(1.658-137.934)	0.016*
Upper West	1.523(0.778-2.981)	0.219	1.889(0.780-4.571)	0.158
Upper East	0.916(0.680-1.468)	0.850	1.122(0.386-3.265)	0.832
Religion				
Christianity	1		1	
Islam	1.191(0.716-1.980)	0.500	0.796(0.364-1.740)	0.568
Traditional	2.812(0.754-10.479)	0.123	4.455(1.015-19.540)	0.048*

**-p<0.10; **-p<0.05; JSH-Junior High School; SHS-Senior High School*

Discussion

The study used the HBM to investigate Ghanaians' perceptions of COVID-19 and factors that may influence their intention to vaccinate. Our findings revealed that a little above 50% of the population perceived a higher chance of contracting COVID-19 and 57.3% were afraid of getting COVID-19. Although 77.3% perceived complications from COVID-19 to be serious, only 57.1% believed vaccination could lessen their worry about contracting the virus. This was because barriers to vaccination were higher among respondents, with the majority (82.3%) being concerned about the authenticity of the vaccines. They, therefore, worried about the efficacy and side effects of the vaccines.

One participant stated, "I'm not taking any risks. A lot of people have been vaccinated and they have had side effects. Some even died, and some still got COVID." Another participant said, "I believe there's an agenda behind it, and it could be faulty or fake and have side effects." The finding is in line with Africa CDC (2020), in partnership with the London School of Hygiene & Tropical Medicine's (LSHTM) study, which reported that an average of 79% of Africans in 15 countries indicated their willingness to take the vaccines if they deemed it effective.

Reasons cited for not intending to vaccinate were: doubts about the efficacy and quality of the vaccine brought to Ghana, the scare of possible side effects, lack of information about vaccines, the misconception that the vaccine was introduced as a way of causing infertility to reduce the population of Africans eventually, the rationale of donor countries, lack of trust in government officials, doubts about the existence of COVID-19, and the belief that the vaccine was at a trial stage and, therefore, unsafe for use. These findings are similar to Hager et al., (2021), who reported distrust in government officials handling the pandemic. Besides, other respondents cited pregnancy and self-immunity.

Some respondents also believed in using traditional or religious methods as alternative remedies for COVID-19. This reflects Pugliese-Garcia et al., (2018), who found that respondents preferred these traditional alternatives to vaccines. Religion is powerful in Ghana and it is, therefore, not surprising that some people prefer to resort to their religious beliefs rather than vaccinations. One participant in our study remarked, "Jesus will heal me."

The media was primarily blamed for fueling hesitancy, as some respondents believed vaccines were created to reduce the population of Africa. Our finding is corroborated by other findings which also cited that misinformation via the media is decreasing people's trust in vaccination (Wirsiy, 2021). Therefore, adequate information (74%) was reported as a strong factor that influenced people to vaccinate. Other cues such as denial of opportunity (35.4%), testing positive (21.3%) and vaccine being taken by many in public did not influence intention to vaccinate.

Only one-fourth of respondents indicated their trust in officials such as doctors and health workers. The low trust in health workers should be seen as a matter of concern, as they are at the forefront of COVID-19.

In Bangladesh, it was found that some people doubted healthcare officials because of how they treated patients (Hossain 2020). Most respondents (56.4 %) cited religious leaders as the most trusted community leaders. This finding is not surprising, as several religious leaders have spoken against the intake of vaccines.

A well-known Nigerian pastor in one of his sermons admonished his church members: "Let me warn you against this deadly thing (vaccine) circulated around the country because it has not been duly tested." An elder of this church, who works with the World Health Organisation (WHO), confirmed this, thanking me for always speaking the truth about the authenticity of the COVID-19 vaccine" (Egbas, 2021).

In an era of COVID-19 where public trust in governments and officials is low, harnessing the influence of community leaders such as religious leaders might go a long way to increase vaccine intake. Countries like Malawi already involve religious and traditional leaders in their vaccination programmes to increase public trust and uptake of COVID-19 (GAVI, 2021). Similarly, the International Committee of the Red Cross (ICRC) is also adopting a similar approach by engaging religious leaders in Gaza to create awareness of the benefits of the COVID-19 vaccine (2021).

A little over half of the respondents indicated their intentions to vaccinate if vaccines became available and readily accessible. The finding is comparatively higher than that of Agyekum et al., (2021), whose study among health workers in Ghana disclosed that only 39% of health workers intended to vaccinate. The intention to vaccinate in Ghana is lower compared to the Africa Centre for Disease Control findings. In Ethiopia, Niger, Senegal, and the Democratic Republic of Congo, 94%, 93%, 65%, and 59% respectively expressed their willingness to vaccinate (Africa Centre for Disease Control, 2020). Since the intention to vaccinate is lower than actual vaccination, efforts to debunk myths and gain trust must be adopted by officials.

As evidenced in the multivariate analysis, age, region and area were predictors for intention to vaccinate against COVID-19. Individuals aged 46-50 had fewer odds of having the intention to get the COVID-19 vaccine. Similar predictive odds were associated with age groups 26-35 and 51-60. However, their associations with having an intention for the COVID-19 vaccine were weaker than those aged 46-50. Therefore, these findings show that persons in their prime productive ages were less willing to be vaccinated against COVID-19.

Our finding corroborates with other studies that found older adults (60 or more years) willing to be vaccinated against COVID-19 (Ogilvie et al., 2021; Ruiz & Bell, 2021; Detoc et al., 2020). The high number of older adults having the intention to get the COVID-19 vaccine has been ascribed to their susceptibility to the disease, which has earlier been heralded by both traditional and new media (Morgan et al., 2021; Zhang & Liu, 2021). These findings could be attributed to reports by health-related organizations that older persons would be much burdened with severe comorbidities if they contracted the disease (WHO, 2020; CDC, 2020).

Also, the findings revealed that respondents who resided in the Central, Northern and Volta regions had lower odds of intentions to vaccinate against COVID-19. Among these regions, those in the Northern Region were much less willing to be vaccinated. These regions identified in our study could be described as places where vaccination rates would be low if the COVID-19 vaccine was available. However, the reasons for the low intention of residents in these regions to opt for the COVID-19 vaccine could not be explained. The varied intention odds across the different regions of Ghana calls for a regional context in designing and implementing COVID-19 vaccination programmes, especially in regions with lower intentions of vaccination.

Our study also espoused the need for more attention to less developed areas in the country. It was found that people in rural areas were less likely to avail themselves of vaccinations against COVID-19. Although this was not statistically significant, it is of much social significance. Notwithstanding the widespread news on COVID-19 globally and regionally, most rural folks are less privy to news and the associated devastation of the pandemic. In addition, insufficient and under-resourced health facilities in rural settings imply that an outbreak could lead to catastrophic circumstances. Subsequently, the rural population need significant consideration in national and regional COVID-19 programmes, even though these rural communities have low population density and witness less mobility. Some of the initiatives meant for rural settings can attain many results if their traditional leaders, as found in this study, spearhead the implementation of COVID-19-related programmes.

Conclusion

In conclusion, there is evidence to indicate that segments of Ghanaians have various perceptions which, somehow, influence their intention to accept the COVID-19 vaccine. Perceived risks such as side effects, which were mostly from misinformation or lack of trust in officials, affect intentions to vaccinate. The main factors associated with acceptance of the COVID-19 vaccine are age, region, and place of residence. Efforts to increase vaccine intake should enhance transparency in COVID-19 and vaccine education. Public education in particular should consider regional, rural, and age-specific needs to make such education effective. Also, since trust in government officials concerning COVID-19 and vaccines is generally low, there is a need to engage community leaders, such as religious and traditional leaders, to lead the front of these public campaigns.

Weakness of the study

The study has one main limitation of selection bias. The type of sampling method (online survey) used could have prevented or missed out on some populations from responding proportionately to the questions across all 16 regions in Ghana. Not everyone in the country had a chance to be part of the survey.

Also, persons who have no access to the internet and not having adequate know-how to operate Facebook and WhatsApp could not be part of the survey. Additionally, those with no Facebook or WhatsApp account, but have access to the internet and can use online media, were excluded. This weakens how the findings might be generalised.

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