# COVID-19 Vaccination Acceptance and Its Associated Factors: Insights from Rural and Urban Settlements in the Yilo Krobo Municipality in Ghana

Louis Kusi Frimpong*[1]
Shine Francis Gbedemah[1]
Fatima Eshun[1]
Paulina Okine[1]
Araba Mbrowa Korsah[1]

## Abstract

*The introduction of COVID-19 vaccines is viewed by many as an important milestone in controlling the spread of COVID-19 and a critical step toward attaining the required threshold for head immunity. However, accepting a vaccine is key to a successful rollout of any vaccination programme. Using the Strategic Advisory Group of Experts on Immunization (SAGE) framework on vaccine acceptance and hesitancy as an analytical framework, this study examines COVID-19 vaccination acceptance and its associated factors in rural and urban settlements in the Yilo Krobo Municipality in Ghana. Data for the study were drawn from a cross-sectional survey conducted in an urban and three rural settlements in the Yilo Krobo Municipality. The findings showed that about 97% of residents were aware of the COVID-19 vaccine rollout exercise in the country; however, only 46% were willing to take the vaccine. The results from the binary logistic regression show that the sex of respondents ($p<0.01$), safety considerations ($p<0.001$), level of information on the vaccine ($p<0.05$), and perceived risk concerns ($p<0.01$) were the key factors that significantly influenced vaccine acceptance in the municipality. The study recommends more public education and sensitization to reduce misconceptions and increase trust in the vaccine rollout exercise.*

**Keywords:** COVID-19 vaccine, immunity, safety concerns, vaccination, Yilo Krobo Municipality

[1]Department of Geography and Earth Science, University of Environment and Sustainable Development, PMB, Somanya, Eastern Region, EY0329-2478

*Corresponding Author's e-mail: kusilouis@gmail.com; lkfrimpong@uesd.edu.gh

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## Introduction

SARS-CoV-2, popularly known as COVID-19, has been clawing on all countries around the globe since its discovery in 2019. On March 11, 2020, the World Health Organization (WHO) declared it a pandemic (Kourlaba et al., 2021). Many countries locked down their cities and towns to avoid spreading the virus. More than 182 million people were infected by COVID-19, with total fatalities of about 3.9 million (as of July 1, 2021), (JHU-CSSE, 2021). The COVID-19 pandemic has had a debilitating impact on people and economies worldwide, the most common being the curtailing of the movement of people within and across national borders. On the economic front, it has led to the contraction of economies, negatively impacting livelihoods and economic activities (Gondwe, 2020). On the flip side, the COVID-19 pandemic has increased global attention on public health issues and has consequently increased investment in public health facilities and services in several countries (Seale et al., 2021).

Following the COVID-19 outbreak, researchers and scientists have made significant efforts to develop a vaccine for the virus with the sole purpose of controlling the pandemic. Indeed, projections were that by late 2020 or early 2021, these vaccines would have been fully developed (Lurie et al., 2020). The belief among scholars was that the introduction of vaccines would open up societies around the globe and provide certainty for controlling the virus (Abdul & Mursheda, 2021; Attwell et al., 2021; Guidry et al., 2021). True to these predictions, vaccines were developed in the latter part of 2020 and culminated in vaccine rollout in the early parts of 2021. Despite the positive impact of introducing the COVID-19 vaccine, Seale et al. (2021) opine that the success of rolling out a vaccination programme will depend on the acceptance and willingness of the population to be vaccinated against COVID-19.

Vaccine uptake is not compulsory; thus, it leaves much discretion to the individual whether they would want to be vaccinated or not. Yet, acceptance to be vaccinated is critical for attaining the required threshold for head immunity (Afolabi & Ilesanmi, 2020; McDermott, 2021). In the case of COVID-19, the willingness or otherwise of people accepting to take the vaccine can have a series of implications for the control of the disease. Dodd et al. (2020) report that population immunity would be achieved if 67% of the population is vaccinated against COVID-19. Other studies report that head immunity requires a threshold of between 55% and 82% (Danchin et al., 2020; Kourlaba et al., 2021). However, research on the global acceptance of COVID-19 vaccines indicates that reaching this threshold would be problematic since about 30% of the population is unlikely to take the vaccine (Aschwanden, 2021; Tam et al., 2020). Danchin et al. (2020) believe that a 10%-15% refusal rate would challenge attaining the required head immunity.

Recent studies on COVID-19 vaccines have paid particular attention to factors influencing vaccine acceptance among the public (see Al-Jayyousi et al., 2021; Crawshaw et al., 2021). Among the factors that have been identified to significantly influence public acceptance of COVID-19 vaccines are socio-demographic variables such as gender, level of education, ethnic minority background, and socioeconomic status measured by income status (Dodd et al., 2020; Paul et al., 2021). The main variable that has shown consistent and significant relationships across space is gender. Females are more unwilling to accept the COVID-19 vaccine compared to males. The main explanation that has been given for female hesitancy is that females have health-related concerns after vaccination, which include perceived side effects of the vaccine (Agyekum et al., 2021; Green et al., 2021; Al-Qerem & Jarab, 2021). In the opinion of Akau (2021), the peculiar health needs of women make them cautious about what goes into their bodies. Further, the link between education and vaccine acceptance is also based on the explanation that people with higher

levels of education are likely to be knowledgeable about the vaccines or seek information and clarification about the vaccine's efficacy (Paul et al., 2021).

Aside from the demographic characteristics, studies have also shown that external factors, such as the level of information flow to the public from official sources about COVID-19 vaccine efficacy, are important in influencing acceptance (Kourlaba et al., 2021; Guidry et al., 2021). When people have adequate information about a vaccine, it improves trust and reduces concerns that the public may have. Health risk and safety concerns about a vaccine is also a variable that influences vaccine acceptance or hesitancy (Trogen & Pirofsk, 2021). When there is perceived health risk and safety concerns, people are unwilling to take vaccines.

To facilitate research on vaccines and immunization, the Strategic Advisory Group of Experts (SAGE) on Immunization has developed a framework to guide researchers in studying the underlying factors that influence vaccine acceptance and hesitancy (MacDonald, 2015; Domek et al., 2018). The SAGE Immunization group was established in 1999, and it is the principal advisory group to the World Health Organization (WHO) for vaccines and immunization. The SAGE framework identifies three broad areas of factors that influence vaccine acceptance. These areas include contextual influences, individual and group influences, and vaccine/vaccination-specific issues. Contextual influences involve the socio-economic and cultural context of people, information and communication systems, and health system and institutions. Individual and group influences include perceived health risks associated with vaccine uptake, knowledge and awareness of the vaccine, beliefs, and past vaccination experiences. The last, which are vaccine-specific issues, also borders on risk and benefits, reliability and vaccine supply, and design of the vaccination programme (SAGE Working Group, 2014).

Africa is one continent that has faced a series of health epidemics in the past (Rugarabamu et al., 2020). Indeed, in 2018, 96 infectious diseases were reported in Africa, of which 85% were epidemic-prone diseases (Mboussou et al., 2019). In February 2020, Africa recorded its first COVID-19 case (Durizzo et al., 2021). Since then, the continent has registered about 4.7 million cases and about 140, 976 deaths (as of July 2021) (WHO, 2021a). Comparatively, this is the lowest to have been recorded in any continent so far. Ghana recorded its first COVID-19 case on 12th March 2020, and after a year, the country has recorded more than 118, 000 cases and more than 1000 deaths (GHS, 2021). Comparatively, Ghana has one of the lowest COVID-19 fatality rates in the world, and it has been touted as one of the countries that have effectively managed the pandemic (Afriyie et al., 2020).

Ghana, just like any other sub-Saharan African country has experienced epidemics and other health crises in time past. Some of these health epidemics have occasioned nationwide vaccination programmes. Indeed, almost every child less than 18 years in Ghana have been vaccinated against the six childhood killer diseases, and once every decade people get vaccinated against yellow fever, hepatitis B, and the likes. Efforts have been made in recent times to increase publicity of the COVID-19 vaccine by the government (see WHO, 2021b), however, hesitancy to the vaccine is on the rise as reported by Head et al. (2021). There are information gaps regarding the vaccine efficacy, which has led to misinformation among the general public. Head et al. (2021) note that there is a false sense of confidence held by health authorities in Ghana, which emanates from a history of successful vaccination campaigns. This notion, they argue, can mask any potential misinformation about the COVID-19 vaccine. For instance, a story in a news media showed that some residents in Krobo-Odumase had demonstrated over the introduction of the vaccine in the community because according to them, they have information that it will change their minds to

vote for the ruling party in the upcoming 2024 elections, while the women also feared that it will seize their menstrual cycle (Annang, 2021). Thus, ascertaining the willingness of people to take the vaccine and what influences their decision is critical for a successful implementation of any vaccination programme. In the opinion of Danchin et al. (2020), understanding the factors influencing the acceptance of the COVID-19 vaccine is crucial to government efforts as it will help in the successful collaboration with communities to build confidence and trust, and also remove doubt or any misinformation in the public domain.

This study seeks to address two important questions: (1) what is the level of public awareness and acceptance of Covid-19 vaccine in rural and urban communities in the Yilo Krobo Municipality, and (2) what factors influence public acceptance of COVID-19 vaccine in rural and urban areas in the Yilo Krobo Municipality. The focus on rural and urban communities in this study is important as it provides some perspectives to the rural-urban divide on vaccine acceptance, an approach which has received little attention in this research area. The study adopts the Strategic Advisory Group of Experts on Immunization (SAGE) framework on vaccine acceptance and hesitancy as the analytical framework for the study.

## Materials and methods

### *Research setting*

The population of the municipality stood at 87,847 as of 2010 (YKMA, 2018). The estimated population figure of the municipality as of 2017 was 95,828, while the reported population figure in 2021 was 122,705. The population of the municipality has increased by 39.6% between 2010 and 2021. According to the Ghana Statistical Service (GSS, 2014), about 34% of the population are within the age category of 15–35 years, and about 37% are below the age of 14. In terms of

sex distribution, 48% of the population are males while 52% are females. The settlement pattern of the municipality shows that it is predominantly rural. About 212 of the 237 settlements in the municipality have a population of less than 500, and the population of these settlements constitutes 61% of the population of the municipality. This situation poses some difficulty for the Municipal Assembly[1] when it comes to the provision of health services since it is impossible to provide health and other social services to this large number of small settlements that spread across the municipality.

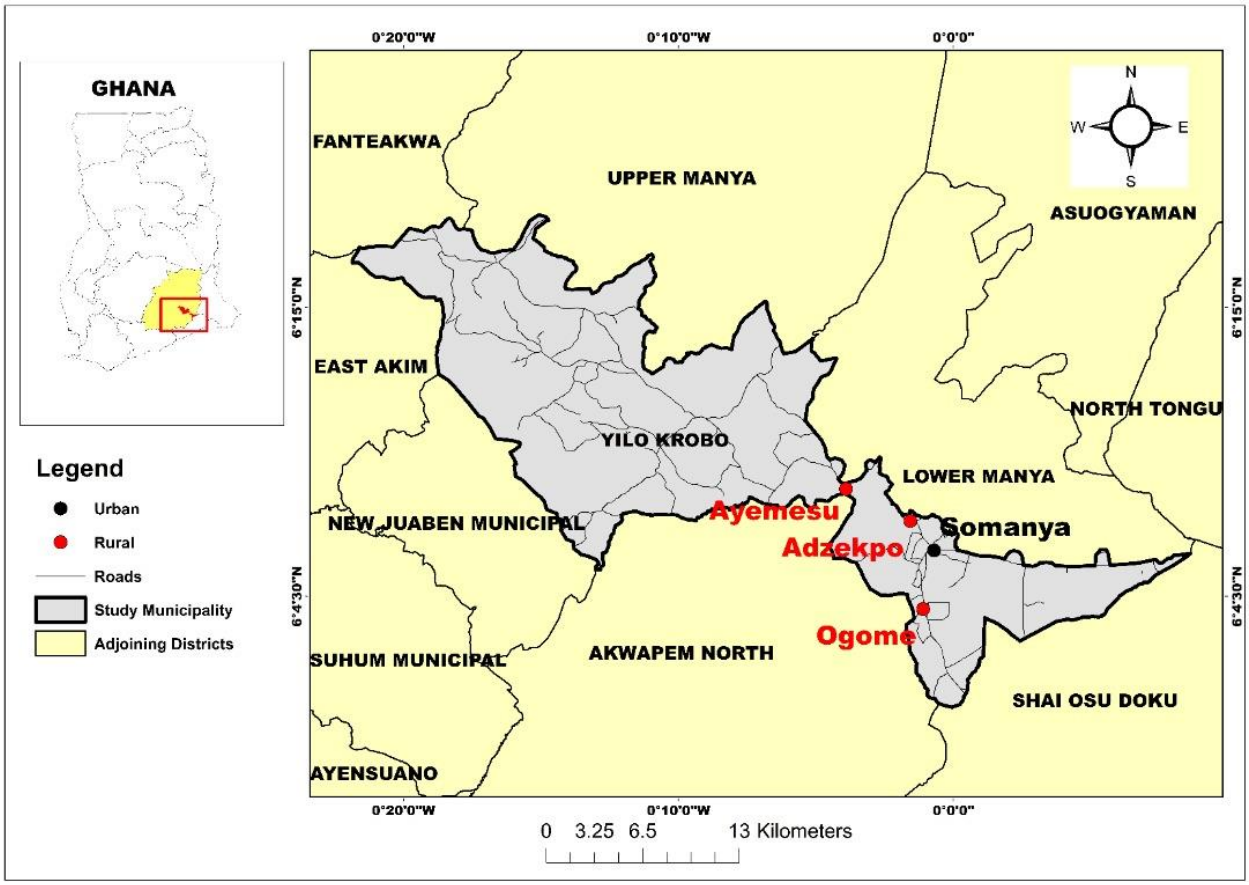


Figure 1: Map of the study area
Source: Authors, 2021

[1] Municipal Assembly is the administrative unit of the Municipality and is in charge of administrating developmental projects in the Municipality. It is headed by the Municipal Chief Executive. Other members of the Assembly include elected members representing electoral areas of the municipality and civil servants.

The disease burden in the municipality is communicable diseases such as cholera, diarrhoea, and malaria (Owusu-Sarpong et al., 2018). Other disease burdens include sexually transmitted diseases (STDs) and non-communicable diseases such as hypertension, diabetes, and mental illness (YKMA, 2018). The dominant health facilities in the municipality are Community-Based Health Planning and Services (CHPS) totalling forty-six (46). Out of this number, ten (10) of the CHPS have compounds and thirty-six (36) do not have compounds. The CHPS serves communities in the municipality and is a national strategy to improve access and utilization and reduce inequities in health care delivery (GHS, 2005). The other health facilities include two (2) Polyclinics and thirteen (13) health centres. Despite the availability of these facilities, health personnel in the municipality are woefully inadequate. The municipality has only one medical doctor, two public health nurses, and seventy-one community health nurses (YKMA, 2018). The ratio of nurses to the population in the municipality is 1:1,312, which is above the World Health Organization approved ratio of 1:1000 (YKMA, 2018). This situation will have negative implications on planned public health programmes like vaccination since there would not be enough personnel to deliver this essential service unless the health officials are brought from other districts in the country.

***Population and sample size***

The target population for the study is residents of the municipality who are 18 years and older. No two persons belonging to the same age group were sampled from the same household. The focus was on the household as an analytical unit because certain questions were specific to the household to which the respondent belonged. The sample size was calculated using a confidence level of 95%, an associated margin of error of 7%, (Israel, 1992) and an estimated total number of households of 20,613. The total sample size obtained was 300, and out of this total sample, 100

(33.3%) were from the rural communities and 200 (66.6%) were from the urban population. Even though the municipality is predominantly rural based on official records, the scattered nature of the rural settlements, the risk of infection, and the fact that some areas were not easily accessible due to the mountainous nature of the municipality led the researchers to draw more samples from urban areas.

***Sample design***

The research design used for this study was a cross-sectional survey. This research design allows for studying attitudes and perceptions of a subset of a population at a point in time (Creswell, 2014). Regarding the sampling strategy, the study adopted a multi-stage sampling procedure for selecting respondents (Fuller, 2011; Lohr, 2019). The first stage involved a stratified sampling of the respondents. At this stage, the population of the study was grouped into urban and rural areas, and a percentage of the sample was assigned to the two groups (i.e. rural and urban). Approximately 66% allocated to the urban area and 33% was allocated to rural areas. This proportion was allocated to the rural areas because of the difficulty with accessibility to the communities such as poor roads, and resource constraints. For rural settlements, the population was randomly sampled because of the small size of the settlements. Approximately 33 respondents were sampled from each of the three rural establishments covered by the sample survey. In the urban area, which was Somanya, the next step after the stratified sampling was a cluster sampling (Lohr, 2019). Here, Somanya was grouped into four (4) clusters where about 50 respondents were randomly sampled within each cluster. The sample survey was carried out in March 2021 by the authors and trained research assistants and covered a time period of three weeks.

***Study variables***

Data collection was conducted during the first week of implementation of the COVID-19 vaccine in the country. Ghana was the first country in the world to receive 600,000 doses of the COVAX AstraZeneca/Oxford vaccine licensed by the Serum Institute of India on 24 February 2021. In all, 12 independent variables and one dependent variable were used for this study. Out of the twelve (12) independent variables, four (4) were individual-level or socio-demographic variables. The variables at the individual level include the sex of respondents, age, level of education and the type of settlement in which the respondent resides (i.e. rural or urban). The other eight (8) independent variables fall under three (3) sets of factors influencing COVID-19 vaccine acceptance. There were four (4) questions on vaccine-specific issues, two (2) variables on personal perceptions and two (2) on beliefs and sociocultural factors.

In terms of coding of the variables, sex of respondents was dichotomous (male=1, female=0), age of respondents was continuous, level of education had five categories (none=1, primary=2, junior high=3, senior high=4, tertiary=5), and type of settlement was also dichotomous (urban=1, rural=0). Variables used to measure vaccine-specific issues include 'It has not been proven to be safe for use', 'It may have side effects after use', 'Information on the vaccine is low', and 'I am not sure if it can increase my immunity'. Variables used to measure personal perceptions include 'I don't know how my body will react to it' and 'I will be putting myself at risk if I take the vaccine early'. For beliefs and sociocultural factors, the variables used include 'I don't trust medicine manufactured abroad' and 'I don't trust the government in their ability to carry out the vaccination programme well'. All variables used to measure these three concepts adapted from the SAGE framework had three categorical options (1=agree, 2=disagree, and 3= don't know).

Table 1 shows the descriptive summary of responses for both the individual-level variables and variables used to measure these three concepts from the SAGE framework. Beginning with the individual level variables, Table 1 shows that 55.4% of respondents were females, while 44.6% were males. The average age of respondents was 37 years, while the minimum and maximum ages were 21 years and 84 years respectively. The results showed that 45.3% of respondents have a maximum primary level of education, while 25.9% and 21.6% of respondents had JHS and SHS as their maximum level of education respectively. In terms of the other predictor variables adapted from the SAGE framework, results from Table 1 show that the majority of respondents indicated that they agreed to statements such as 'It has not been proven to be safe for use', 'It may have side effects after use', 'Information on the vaccine is low' and 'I am not sure if it can increase my immunity'. However, Table 1 also shows that the majority of respondents disagreed with statements such as 'I don't trust medicine manufactured abroad' and 'I don't trust the government in their ability to carry out the vaccination programme well'.

Table 1: Case Processing Summary of Categorical Variables

| Variables | Categories | Frequency | Percentage |
|---|---|---|---|
| Dependent variables | | | |
| Would you like to take the COVID-19 vaccine | Yes | 126 | 45.3 |
| | No | 152 | 54.7 |
| Independent variables | | | |
| Sex | Male | 124 | 44.6 |
| | Female | 154 | 55.4 |
| Age | Continuous | | |
| Education | None | 12 | 4.3 |
| | Primary | 126 | 45.3 |
| | Junior High | 72 | 25.9 |
| | Senior High | 60 | 21.6 |
| | Tertiary | 8 | 2.9 |
| Settlements | Urban | 190 | 68.3 |
| | Rural | 88 | 31.7 |
| It has not been proven to be safe for use | Agree | 130 | 46.7 |
| | Disagree | 82 | 29.5 |
| | Don't know | 66 | 23.7 |
| It may have side effects after use | Agree | 160 | 57.6 |
| | Disagree | 60 | 22.6 |
| | Don't know | 56 | 20.8 |
| Information on the vaccine is low | Agree | 182 | 65.5 |
| | Disagree | 68 | 24.5 |
| | Don't know | 28 | 10 |
| I am not sure if it can increase my immunity | Agree | 120 | 43.2 |
| | Disagree | 100 | 36 |
| | Don't know | 58 | 20.8 |
| I don't know how my body will react to it | Agree | 150 | 54 |
| | Disagree | 82 | 29.5 |
| | Don't know | 46 | 16.5 |
| I will be putting myself at risk if I take the vaccine early | Agree | 130 | 46.8 |
| | Disagree | 94 | 33.8 |
| | Don't know | 54 | 19.4 |
| I don't trust medicine manufactured abroad | Agree | 93 | 33.5 |

Source: Field Survey, 2021

### *Analytical strategy*

The data were analysed using descriptive, bivariate, and multivariate analytical methods generated from SPSS version 22.0. Descriptive analysis using percentages were used to summarize respondents' awareness and willingness to take the COVID-19 vaccine. This descriptive analysis was also disaggregated at the spatial level to provide a rural and urban summary of respondents' awareness and willingness to take up the COVID-19 vaccines. Concerning the bivariate analysis, the chi-square test was conducted for all IVs and the DV using SPSS version 22.0. Chi-square test results and Phi and Crammer's V test values were reported as the bivariate results as shown in Table 2. The purpose for conducting the chi-square test, and the Phi and Crammer's V test was to assess the relationship between IVs and DV in terms of significance and strength. This analysis is an initial assessment before proceeding to conduct the multivariate analysis. The multivariate analysis involved a binary logistic regression. This method was appropriate due to the dichotomous nature of the dependent variable (Cleary & Angel, 1984). In terms of the interpretation of the binary logistic regression results, the odds ratio was used (Agresti, 2019). For categorical independent variables, a significant odds-ratio with a value greater than one indicates a higher likelihood of respondents not taking the vaccine, while a significant odds-ratio with a value less than one indicates a lower likelihood of responding would not take the vaccine.

## Results

### *Awareness of COVID-19 vaccine*

Figure 2 shows two charts on public awareness of the COVID-19 vaccine rollout. One of the charts in Figure 2 shows a summary of awareness for all respondents and the other for respondents in rural and urban areas. The result showed that about 97% of respondents surveyed in the municipality were aware of the vaccination programme being rolled out in the country. This result

demonstrates that respondents are well aware of what is currently going on or being done in the country concerning the COVID-19 vaccine rollout exercise. The study also established that there was a high awareness of the vaccine exercise in both rural and urban communities in the municipality.

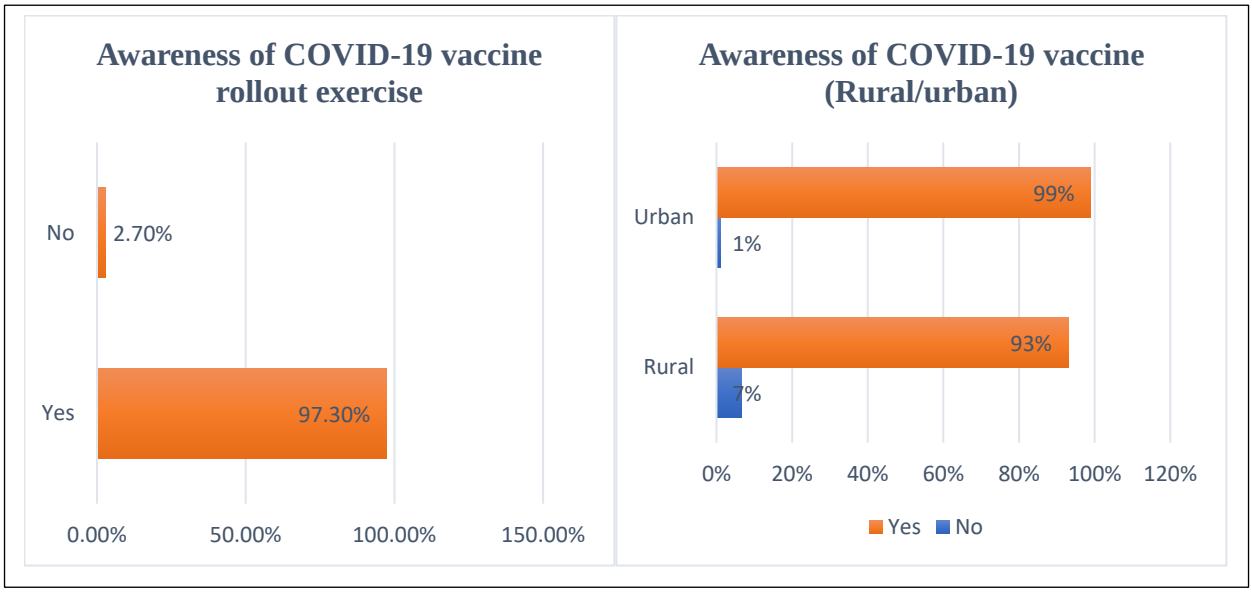


Figure 2: Awareness of COVID-19 vaccine rollout in Ghana

***Willingness to take the COVID-19 vaccine.***

While public awareness of a health programme is important, especially for a health issue like COVID-19, decisions concerning participation in such programmes are based on some considerations. The result in Figure 3 shows two charts on the willingness of residents to take COVID-19 vaccines. One of the charts shows the responses of the entire respondents of the study, while the other shows the responses of respondents from rural and urban communities selected in the study. The findings in Figure 3 show that 54% of the total respondents opined that they would not take the COVID-19 vaccine. The results further reveal that 63% of respondents sampled from

rural areas opined that they would not take the COVID-19 vaccine being rolled out, while 50% of the respondents sampled in the urban area responded that they would not take the vaccine.

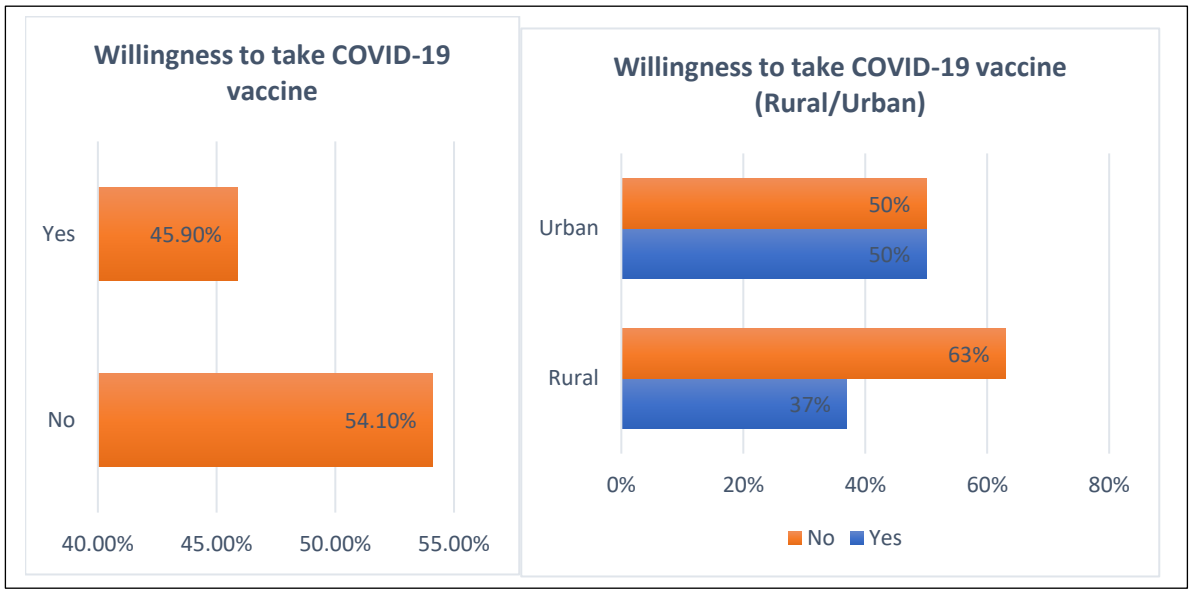


Figure 3: Willingness to take COVID-19 vaccine

### *Factors influencing vaccine acceptance*

*Bivariate analysis*

This section presents the results of the chi-square test performed between the DV and the IV. Table 2 presents the chi-square value, Phi and Crammer's V test values, and the level of significance of the relationship. Results from Table 2 point out that there was a significant relationship between the sex of respondents and their willingness to take the COVID-19 vaccine. Other individual-level variables that were significantly related to willingness to take the COVID-19 vaccine included the level of education and type of settlement a person resides. The results reported in Table 2 were extracted from contingency tables generated[2]. Observation from the contingency tables showed

[2] Contingency tables were not presented in this paper due to limited space, and more so the athors wanted the results presented to be more concise. Thus, the Chi-sqaure and the Phi and Crammer's V test values were presented.

that more females were unwilling to take the vaccine compared to males, and a larger proportion of residents in rural areas (in percentage terms) were unwilling to take the vaccine. Despite the reported significant relationships for the demographic variables, the Phi and Crammer's V test showed that these relationships were weak, with none being 0.200.

Variables used for the three sets of factors (i.e. vaccination specific issues, personal perception, beliefs, and socio-cultural factors) were significantly related to willingness to take the COVID-19 vaccine as reported in Table 2. Unlike the individual-level variables, the strength of the relationships between variables used for the three sets of factors and willingness to take the COVID-19 vaccine were moderate as reported by the Phi and Crammer's V values.

Table 2: Chi-square, and Phi and Crammers V test values for the relationship between IVs and DV

| Independent variables | $X^2$ | P-value | Phi | Crammer | Valid cases |
|---|---|---|---|---|---|
| Individual-level factors | | | | | |
| Gender | 5.685 | 0.017 | 0.139 | 0.139 | 296 |
| Age | 1.567 | 0.815 | 0.075 | 0.075 | 282 |
| Education | 11.766 | 0.019 | . 199 | . 199 | 206 |
| Settlements | 4.343 | 0.037 | 0.121 | 0.121 | 296 |
| Vaccination specific issues | | | | | |
| It has not been proven to be safe for use | 103.55 | 0.000 | 0.593 | 0.593 | 294 |
| It may have side effect after use | 101.25 | 0.000 | 0.587 | 0.587 | 294 |
| Information on vaccine is low | 20.281 | 0.000 | 0.263 | 0.263 | 294 |
| I am not sure if it can increase my immunity | 76.644 | 0.000 | 0.511 | 0.511 | 294 |
| Personal perception | | | | | |
| I don't know how my body will react to it | 33.738 | 0.000 | 0.34 | 0.34 | 292 |
| I will be putting myself at risk if I take the vaccine early | 61.531 | 0.000 | 0.457 | 0.457 | 294 |
| Beliefs and socio-cultural factors | | | | | |
| I don't trust medicine manufactured abroad | 49.545 | 0.000 | 0.411 | 0.411 | 294 |
| I don't trust the government in their ability to carry out the vaccination programme well | 60.756 | 0.000 | 0.455 | 0.455 | 294 |

*Multivariate analysis*

Table 3 reports findings from the logistic regression model. The result shows that sex of respondents was significantly related to willingness to take the COVID-19 vaccine. The result further reveals that when compared to females, males were 0.315 times less likely to take the COVID-19 vaccine (OR=.315 $p<.01$). In other words, males are more likely to take the COVID-19 vaccine than females. Aside from sex of respondents, the remaining individual-level variables shows no significant relationship with willingness to accept Covid-19 vaccine.

Table 3: Regression of vaccine acceptance on independent variables

| Independent variables | B | Odds-ratio | S.E |
|---|---|---|---|
| Gender | | | |
| *Male* | -1.154 | .315** | 0.431 |
| Age | -0.022 | 0.979 | 0.015 |
| Education | | | |
| *None* | 2.417 | 6.627 | 0.363 |
| *Basic* | 2.063 | 2.764 | 0.323 |
| *SHS* | 2.303 | 2.176 | 0.243 |
| Settlements | | | |
| *Urban* | -0.131 | 0.877 | 0.594 |
| It has not been proven to be safe for use | | | |
| *Agree* | -0.242 | 0.785 | 0.719 |
| *Disagree* | -3.487 | .031*** | 0.902 |
| It may have side effects after use | | | |
| *Agree* | 0.173 | 1.136 | 0.065 |
| *Disagree* | -0.321 | 0.412 | 0.169 |
| Information on the vaccine is low | | | |
| *Agree* | 1.159 | 3.188* | 0.772 |
| *Disagree* | -2.522 | .454* | 0.806 |
| I am not sure if it can increase my immunity | | | |
| *Agree* | 0.423 | 1.526 | 0.639 |
| *Disagree* | -0.582 | 0.559 | 0.742 |
| I don't know how my body will react to it | | | |
| *Agree* | 1.937 | 3.144** | 0.904 |
| *Disagree* | -0.994 | 0.112 | 0.862 |
| I will be putting myself at risk if I take the vaccine early | | | |
| *Agree* | 1.979 | 7.231** | 0.699 |
| *Disagree* | 0.478 | 1.613 | 0.704 |
| I don't trust medicine manufactured abroad | | | |
| *Agree* | -0.262 | 0.769 | 0.74 |
| *Disagree* | 0.373 | 1.452 | 0.827 |
| I don't trust the government in their ability to carry out the vaccination programme well | | | |
| *Agree* | -0.755 | 0.47 | 0.948 |
| *Disagree* | -1.147 | 0.318 | 0.753 |
| Pseudo R2 (C&S) | | 0.542 | |

Note: Exp (B) is exponentiated beta (or odds-ratio), SE is standard error, *p < 0.05 **p < 0.01 ***p < 0.001

Regarding the SAGE framework variables used in the study, four (4) out of the eight variables were found to be significantly related to willingness to take up the COVID-19 vaccine. The results showed that respondents who disagreed that the COVID-19 vaccine has not been proven to be safe for use were .031 times less likely to respond they will not take the COVID-19 vaccine (OR=.031 p<.001). Respondents who agreed that information on the COVID-19 vaccine was low were 3.188 times more likely to respond that they will not take the COVID-19 vaccine (OR=3.188 p<.05), while those who disagreed that information on the COVID-19 vaccine was low were 0.454 less likely to respond that they will not take the COVID-19 vaccine (OR=.454 p<.05). In other words, the likelihood of taking the COVID-19 vaccine was higher for those who had more information on the vaccine.

The result in Table 3 further shows that respondents who agreed that they do not know how their bodies will react to the vaccine were 3.144 times more likely to respond that they will not take the COVID-19 vaccine (OR=3.144 p<.01). Further, respondents who agreed that they will be putting themselves at risk if they take the vaccine early were 7.231 times more likely to respond that they will not take the COVID-19 vaccine (OR=7.231 p<.01).

## Discussion

The findings from this study provide useful insight into COVID-19 vaccine awareness and the factors that influence people's willingness to accept the COVID-19 vaccine in rural and urban communities in the Yilo Krobo Municipality of Ghana. The study provides insight into issues that policymakers must seriously consider if they are to undertake a successful vaccine rollout exercise in Ghana. A WHO news portal reported that as of July 2021, only 2.7% of the country's population had been fully vaccinated, which was above Africa's average of just 1.6% during the same period (WHO, July 2021c). The news portal also reported that there were challenges with vaccine uptake

in communities in the country's hinterlands, or what it referred to as hard-to-reach communities, attributing this to misconceptions about the vaccine in these parts of the country. Therefore, the findings of the study can provide useful lessons for policymakers in the planning and rollout of vaccination programmes in far-flung communities in the country. The findings showed a high public awareness of the COVID-19 vaccine rollout in the study communities. In this study, awareness is limited to public knowledge about the vaccine and not necessarily information on its efficacy. While awareness was high in the study communities, acceptance of the vaccine was low, with half of the urban population and a third of the rural population expressing unwillingness to accept the COVID-19 vaccine. This finding corroborates recent studies that have reported increasing vaccine hesitancy among the Ghanaian populace (Head et al., 2021). Further, misinformation about the vaccine is also a probable causative factor for the increased levels of hesitancy in the study.

The findings showed that the demographic variable that consistently influenced the acceptance of the COVID-19 vaccine was the sex of respondents. Here, females were less likely to accept the vaccine compared with males. This finding is consistent with other studies, such as Agyekum et al. (2021) and Green et al. (2021), which reported that demographic variables such as the sex of respondents were significant predictors of vaccine hesitancy or acceptance. Corroborating this point, Al-Qerem and Jarab (2021) in their study also found that female participants were less likely to accept COVID-19 vaccines. The authors attributed females' hesitancy to take the COVID-19 vaccine to perceived health risks and concerns about the side effects, including possible implications with childbirth, menstrual cycle, etc. The above findings also corroborate arguments by Akau (2021) and Sallam et al. (2021) that males are more willing to accept the COVID-19

vaccine than females because females have more concerns about associated health risks when taking any form of medication.

Another factor identified as a predictor of COVID-19 vaccine acceptance was the safety concerns people have about the vaccine. Safety concerns arise out of people's lack of confidence and trust in the vaccine and more importantly, the belief that it will have a debilitating impact on their health. Indeed, there has been widespread misinformation about the vaccine in Ghana, and the Krobo-Odumase example alluded to earlier in the article is a case in point. This finding is consistent with other related studies in the United States and Europe (Razai et al., 2021; Reno et al., 2021). Safety concerns also hinge on the adequacy of reliable information about the vaccine. Unsurprisingly, the study also found that low information also reduced the likelihood of vaccine acceptance. The finding on vaccine information is in synch with other related literature, such as Trogen and Pirofsk (2021). The relevance of adequate and reliable information is that it clears doubt on the vaccine's efficacy and increases confidence and trust in the vaccine.

The study also established that uncertainties about respondents' reactions to vaccines and risks associated with vaccine uptake were among the factors that reduced respondents' willingness to take the vaccine. These factors express negative emotions and anxieties about the vaccine will have on their health. The above findings are similar to a study from Italy that showed vaccine hesitancy is influenced by negative emotions and attitudes (Gerussi et al., 2021). The above finding can also be situated within the context of Ghana and the study area in particular. Admittedly, there have been campaigns about COVID-19 and the need to adhere to preventive measures. While there has been some awareness of the vaccine, these have been mainly done on national television. Unfortunately, and based on the findings, which provide evidence of some level of concerns and anxieties about the impact of the vaccine on respondents' health, it will be appropriate to suggest

that information about the vaccine is carried to the community level to reduce the risk concerns people have about the vaccine.

The study's findings also support and give much credence to the SAGE framework on vaccine hesitancy and acceptance. Specifically, two of the three factors were associated with COVID-19 vaccine acceptance or hesitancy. These include vaccine-specific issues and personal perceptions. The insignificant relationship between socio-cultural factors and willingness to accept the COVID-19 vaccine shows that vaccine hesitancy in the study area has much more to do with personal factors or considerations, which bother the risk and safety concerns of respondents about the vaccine. This study finding corroborates claims by the SAGE-working group (2014) that morbidity and mortality rate associated with a disease is not sufficient condition for the acceptance of a vaccine, rather, it depends on a successful campaign in convincing the populace about the safety of the vaccine. In addition, findings from this study fit well into the risk-benefit (scientific evidence) category of the SAGE framework.

## Conclusion

This study aimed to examine two questions, and these were (1) what is the level of COVID-19 vaccine awareness and acceptance in urban and rural settlements in rural and urban communities in Ghana and (2) what are the factors influencing COVID-19 vaccine acceptance in rural and urban communities in Ghana. The study found that awareness of the vaccine rollout exercise in the country was very high. Furthermore, the study revealed more hesitancy in taking the COVID-19 vaccine in rural areas than in urban areas. Key factors that were identified as significantly influencing COVID-19 vaccine acceptance in the study area include the sex of respondents, safety considerations about the vaccine, level of information on the vaccine, and perceived health risks

of taking the vaccine, which is all within the World Health Organization's (WHO) SAGE working group's framework. Based on the findings, the authors recommend more community-based education and sensitization to reduce misconceptions about the COVID-19 vaccines being rolled out in the country. There should also be community-level engagement with support from community leaders and faith-based organizations to alleviate uncertainties and increase voluntary cooperation.

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