ORIGINAL RESEARCH

Factors Associated with COVID-19 Vaccine Hesitancy in Uganda: A Population-Based Cross-Sectional Survey

Allen Kabagenyi 🄿[1], Ronald Wasswa 🄿[2], Betty K Nannyonga[3], Evelyne B Nyachwo[4], Atek Kagirita[5], Juliet Nabirye[4], Leonard Atuhaire[6], Peter Waiswa[4]

[1]Department of Population Studies, School of Statistics & Planning, College of Business and Management Sciences, Makerere University, Kampala, Uganda; [2]Department of Statistical Methods and Actuarial Science, School of Statistics & Planning, College of Business and Management Sciences, Makerere University, Kampala, Uganda; [3]Department of Mathematics, School of Natural Science, College of Business and Management Sciences, Makerere University, Kampala, Uganda; [4]Health Policy, Planning and Management, School of Public Health, Makerere University, Kampala, Uganda; [5]Department of National Disease Control, Ministry of Health, Kampala, Uganda; [6]Department of Planning and Applied Statistics, School of Statistics & Planning, College of Business and Management Sciences, Makerere University, Kampala, Uganda

Correspondence: Allen Kabagenyi, Department of Population Studies, School of Statistics & Planning, College of Business and Management Sciences, Makerere University, Kampala, Uganda, Email allenka79@yahoo.com

Purpose: Vaccination toward coronavirus disease (COVID-19) has been recommended and adopted as one of the measures of reducing the spread of this novel disease worldwide. Despite this, vaccine uptake among the Ugandan population has been low with reasons surrounding this being unknown. This study aimed to investigate the factors associated with COVID-19 vaccine hesitancy in Uganda.

Methods: A cross-sectional study was conducted on a total of 1042 adults in the districts of Mukono, Kiboga, Kumi, Soroti, Gulu, Amuru, Mbarara and Sheema from June to November 2021. Data were analyzed using STATA v.15. Barriers to vaccination were analyzed descriptively, while a binary logistic regression model was used to establish the factors associated with COVID-19 vaccine hesitancy.

Results: Overall, COVID-19 vaccine hesitancy was 58.6% (611). Respondents from urban areas and those in the eastern or northern region had increased odds of vaccine hesitancy. Further, higher education level and having knowledge on how COVID-19 is transmitted significantly reduced the odds of vaccine hesitancy. The study also noted individual perception such as COVID-19 kills only people with underlying medical conditions, as well as limited awareness on vaccine types or vaccination areas as the main reasons to vaccine hesitancy. Relatedly, other misconceptions like the ability of the vaccine to cause infertility, or spreading the virus into the body, and acknowledgment of alcohol as a possible cure were other reasons for vaccine hesitancy.

Conclusion: The proportion of COVID-19 vaccine hesitancy is still high among the population with this varying across regions. This is driven by low education level and limited awareness on the vaccination as well as perceived myths and misconceptions. The study recommends mass sensitization of the population on the benefits of vaccination using various channels as well as rolling out community-based outreach vaccination campaigns across the country.

Keywords: COVID-19, vaccination, hesitancy, barriers, pandemic, Uganda

Introduction

The World Health Organization (WHO) identified vaccine hesitancy as one of the top ten threats to global health[1] and this remains a challenge to many countries.[2,3] Evidently, research shows that vaccination is essential in the prevention of infections, morbidity and reducing mortality for a number of existing infectious diseases.[4] Undoubtedly, the COVID-19 pandemic distorted the health, social, economic wellbeing and the quality of life some of which could be averted with vaccinations.[5] As one of the measures of reducing the impact of the pandemic globally, the World Health Organization

recommended worldwide vaccination of populations against the novel virus. Despite all these measures, the uptake of the COVID-19 vaccine among different populations remains low with limited studies providing the possible explanations.[2,3]

COVID-19 vaccine hesitancy does not only exist among the common population, but also among health workers despite vaccines being available.[6] COVID-19 vaccine hesitancy has been attributed to fear of adverse effects and doubts about the effectiveness of the vaccines.[7,8] In addition, in low income countries, COVID-19 vaccine hesitancy has been linked to inaccessibility of vaccination health facilities, global vaccine supply chain dynamics, vaccine preference and perceived misconceptions.[3,9–11] It has been documented that higher education level, adequate knowledge about COVID-19 virus and the vaccines, as well as the presence of confirmed COVID-19 infections in the neighborhood significantly reduce the likelihood COVID-19 vaccine hesitancy.[7,8] Further, demographic factors such as work place, occupation, parity, age and sex/gender have also shown association with COVID-19 vaccine hesitancy.[7,8,12]

According to the Ministry of Health, Uganda needed a total of 45 million doses of vaccines (if all vaccines provided were of two doses) to vaccinate a population of about 22 million as well as refugees with the eligibility age of years 18 and above in a phased manner.[13] By the end of March 2021, the government had received a total of 964,000 doses though its uptake was very low.[13] Previous studies elsewhere have reported a significantly higher proportion of people that want to receive the vaccine given an opportunity.[2,3]

Given the challenges associated with vaccine hesitancy and the documented evidence of the benefits of vaccination, the development of a proper communication strategy in providing vaccine efficacy information is crucial especially in low income countries.[10] In this study we aimed to examine factors associated with COVID-19 vaccine hesitancy in Uganda. Specifically, the study examined: 1) the proportion of the population that was hesitant to vaccination; and 2) the factors associated with COVID-19 vaccine hesitancy. The intended purpose was to provide information for policy guidance and implementation as the vaccines were being rolled throughout the country.

Materials and Methods
Study Design, Setting and Population
This was a quantitative population-based cross-sectional study carried out in four statistical regions of the country with a total of two districts randomly sampled from each of the regions as presented in Figure 1. The selection of districts was guided by the Ministry of Health-Uganda's top ten and bottom ten performing districts in COVID-19 vaccine uptake rates. As vaccines were being rolled out the National Immunization Technical Advisory Group (NITAG) and Incident Management Team (IMT) tracked district-based COVID-19 vaccination rates with a ranking for all the 135 districts in the country. Specifically, the sampled districts include Mukono and Kiboga in Central, Kumi and Soroti in East, Gulu and Amuru in North while Mbarara and Sheema from West. Of these, Kiboga, Kumi, Amuru and Mbarara were among the low performing districts while Mukono, Soroti, Gulu and Sheema were ranked as high performers in the vaccine uptake.[13] We employed a stratified multistage sampling followed by systematic random sampling method to obtain a representative sample of respondents. At the first stage of sampling, two sub-counties were randomly selected from the respective districts with one being in rural and the other in urban setting. This was then followed by a simple random selection of one parish from the respective sub-counties. The selected parishes acted as enumeration areas where lists of all villages in the respective parishes were used to arrive to respondents at the household level. At household level, a systematic sampling method was used basing on the sampling frame of the household lists generated at the village level.

The sample size estimation of this study was based on the Leslie Kish's sampling procedures for cross-sectional studies. The following formula was used:[14]

$$n = \frac{z(^{\alpha}\!/_{2})^{2}p(1-p)}{\varepsilon^{2}}$$

Where: n sample size, $z(^{\alpha}\!/_{2})$ = confidence interval (95%), p = proportion of COVID-19 uptake in the country (50%), ε =margin of error (5%).

Thus, adjusting for the sampling design using a design effect of 2 and catering for non-response as well as missing values, a final size of 1042 respondents was generated. The sample size was then distributed basing on the probability
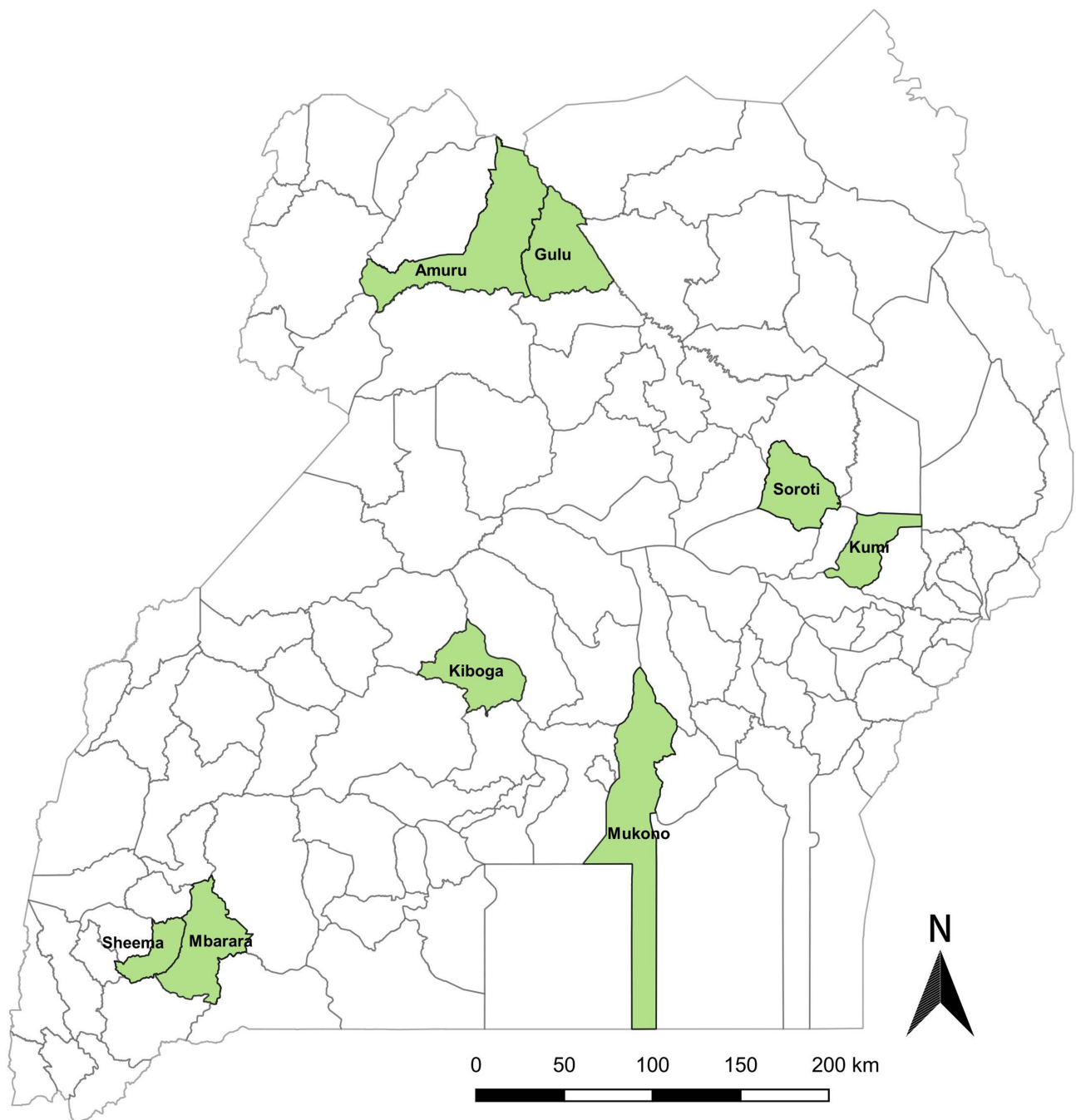
Figure 1 Study sites.

proportional to size of the district as well as rural–urban residence. All adults aged 18 and above were eligible for participation in the study.

Data Collection

Data were collected with face to face interview structured questionnaire for each of the sampled households. Experienced and qualified research assistants with at least a Bachelor's degree were recruited and trained intensively for 5 days on the methods of data collection, sampling and on each of the sections included in the questionnaire. The tool comprised sections on socio-demographic characteristics, knowledge on COVID-19, individual intention on COVID-19 vaccination,

as well as concerns, perceptions, attitudes and misconceptions on COVID-19 and the vaccine. The questionnaire was prepared in English and then translated to local languages used in the selected districts (Luganda, Runyankole, Rutoro, Ateso and Acholi). The tool was then uploaded on Android tablets using Kobo collect and data collected electronically by the trained research assistants. A pretest survey was conducted within Kampala district and identified problems during the survey were corrected before the actual survey. Four regional supervisors and the principal investigator supervised the entire data collection process from June to November 2021.

Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki for studies on human subjects. Authors received ethical clearance from the Uganda National Council of Science and Technology with registration number SS951ES and Mildmay Uganda Research Ethics Committee (MUREC-2021-40) for this study.

Informed Consent and Confidentiality

All respondents were provided with a written summary regarding the research and contact information of the principal investigator. They were assured of the confidentiality of the information collected, and written informed consent was obtained. During the consenting process, the participants were assured of the publication of only anonymized responses or information.

Study Variables

Dependent Variable

The outcome variable for this study was COVID-19 vaccine hesitancy. A binary response question was asked to all participants on whether they were vaccinated (yes/no). All those who were vaccinated were coded 0. As a follow up, those who were not vaccinated were asked whether they would want to be vaccinated if the vaccine is available. This had two possible responses (yes/no). Participants who admitted that they do not want to be vaccinated were automatically considered to be hesitant (coded 1). In addition, those who responded that they would want to be vaccinated were further followed up by the question that required them to state their plan (urgency) to acquire the vaccine dose. This was a scaled response with very likely, likely, unlikely, very unlikely and do not know as possible options. Therefore, respondents who showed their interest to be vaccinated and yet their plan to go for this vaccine dose if made available was not known, unlikely and very unlikely were also assumed to be hesitant and thus coded 1. Those who stated otherwise were coded 0.

Independent Variables

The predictor variables were grouped into two (demographic and socioeconomic factors and COVID-19 awareness factors). Demographic and socioeconomic factors include: age (18–24, 25–34, 35–44, 45–54, 55+), region (Central, East, North, West), gender (male, female), place of residence (rural, urban), and household size (1–2, 3–4, 5+). Other variables include: education level (no education, primary, secondary, higher (tertiary and university), working status (unemployed, employed), religion (Catholic, Protestant, Muslim, Others for Pentecostal/Seventh Day Adventist) and marital status (single, cohabiting, married, separated/divorced/widow or widower). Access to media was also considered and this was measured by a question that required respondents to state the frequency on reading newspapers, listening to radio and watching television. All responses were aggregated to generate an index with three categories for this variable (no exposure, 1 of 3 sources, 2 of 3 sources, access to all sources).

COVID-19 awareness factors include: awareness on any COVID-19 vaccine (respondents were asked whether they know or heard of any COVID-19 vaccine with a binary response of yes or no).

Knowledge on the ways of transmitting COVID-19. With this, respondents were asked to identify the ways in which COVID-19 can be transmitted from one person to another. The possible options were: through droplets or aerosols (as a result of coughing, sneezing or talking) from the infected person; airborne transmission (where the virus can live in the air for up to 3 hours and later enters into the lungs); surface transmission (touching a contaminated surface and then touch the nose, mouth or eyes). This was binary in nature with yes=1 if the respondent was aware on all the three ways and no=0 if otherwise.

Statistical Analysis

All data were cleaned and analyzed using STATA version 15 statistical software. We ran descriptive statistics to summarize the characteristics of the study population. In order to determine the factors associated with COVID-19 vaccine hesitancy, bivariate binary logistic regression analyses were done and the 95% confidence level was used to determine the strength of association between the predictors and dependent variable. Variables whose p-value were less than 0.2 in bivariate level were considered for further analysis and fitted in to multivariate binary logistic regression model. A p-value <0.05 in multivariable analysis was considered as statistically significant.

Results

Table 1 presents the descriptive summary of the selected characteristics among the study participants. In the results, the average age of the study participants was 40 years while 3 in 10 (27%) were aged 25–34 years. Further, the majority of participants were female (56%), residing in rural areas (59%) and employed (86%). Of these, a great number were also from the Central region (36%) with a household size of at least five (71%). The results also show that 38% were either Catholic or Anglican, 50% were married while only 2 in 10 could access all the three forms of media (newspapers, radio and television). In relation to COVID-19, 23% of the study population had knowledge on all the ways of transmitting the virus and a large proportion (51%) was not aware on any COVID-19 vaccines. Relatedly, results also revealed that only 16% were vaccinated and more than half (59%) of the participants were hesitant to COVID-19 vaccination. In addition, out those who were not vaccinated, 15% were not willing to be vaccinated while only about 36% showed urgency for the vaccine (Table 1).

Reasons for COVID-19 Refusal and Hesitancy

All participants who were hesitant in receiving the COVID-19 vaccine were asked about their reasons for refusal (Table 2). The majority of the respondents (70%) did not know of any vaccination sites in their respective districts while more than half (55%) lacked awareness on any vaccine type. Also, a bigger proportion (68%) believe that government officials should be immunized first before rolling out to the entire population. Other reasons were attributed to the myths and misconceptions about the virus and the vaccine itself. In the survey, 15% acknowledged that the vaccine could make people infertile or the vaccine could spread the virus into their bodies thus getting them infected. Relatedly, 8%, 10% and close to 1 in 5 perceived that COVID-19 is not a serious illness, that the vaccine does not work and COVID-19 kills only people with underlying medical conditions respectively. Drinking alcohol protects against COVID-19 (31%) and eating garlic as a cure for COVID-19 (41%) were also prominent reasons for refusal or vaccination hesitancy.

Factors Associated with COVID-19 Vaccine Hesitancy

The unadjusted results in Table 3 indicate that the following factors were significantly associated with increased odds of having vaccine hesitancy: western region, household size of five or more, being separated/divorced/widowed and having an awareness on the vaccine. On the other hand, odds ratio of COVID-19 vaccine hesitancy reduced as: education level increased, access to more sources of information, as well as having knowledge on the ways of transmitting the virus. Relatedly, participants living in urban setting, those from the eastern and northern region as well as male sex were less likely to be hesitant. Respondent's age, working status and religion were dropped in the final model (multivariate analysis) because of their high p-values (p-value>0.2).

   After adjusting and controlling for possible confounders, results in Table 3 show that people in the urban areas were less likely to experience vaccine hesitancy compared to their counterparts in the rural areas (AOR=0.74, 95% CI=0.55–0.99). Findings also showed that individuals from the eastern (AOR=0.66, 95% CI=0.46–0.95) or northern region (AOR=0.55, 95% CI=0.35–0.83) had reduced odds of vaccine hesitancy while their counterparts in the west experienced the reverse (AOR=1.63, 95% CI=1.07–2.43). Additionally, individuals with higher education level (AOR=0.50, 95% CI=0.27–0.93) and those having knowledge on the ways of transmitting the virus (AOR=0.47, 95% CI=0.34–0.64) were less likely to have COVID-19 vaccine hesitancy.

Table 1 Distribution of the Study Population by Socioeconomic and Demographic Characteristics

Variable	Frequency (N=1042)	Percentage (%)
Age		
18–24	168	16.1
25–34	283	27.2
35–44	229	22.0
45–54	165	15.8
55+	197	18.9
Place of residence		
Rural	610	58.5
Urban	432	41.5
Region		
Central	378	36.3
East	254	24.4
North	195	18.7
West	215	20.6
Sex		
Female	580	55.7
Male	462	44.3
Education level		
No education	109	10.5
Primary	397	38.1
Secondary	327	31.4
Higher	209	20.1
Working status		
Unemployed	142	13.6
Employed	900	86.4
Household size		
1–2	78	7.5
3–4	221	21.2
5+	743	71.3
Access to media		
No exposure	114	10.9
1 of 3 sources	405	38.9
2 of 3 sources	299	28.7
All sources	224	21.5
Religion		
Catholic	391	37.5
Anglican	394	37.8
Muslim	90	8.6
Other	167	16.0
Marital status		
Single	177	17.0
Cohabiting	195	18.7
Married	522	50.1
Separated/divorced/widowed	148	14.2
Knowledge on the ways of transmitting COVID-19		
No	802	77.0
Yes	240	23.0

(*Continued*)

Table 1 (Continued).

Variable	Frequency (N=1042)	Percentage (%)
Awareness of any COVID-19 vaccine		
No	534	51.2
Yes	508	48.8
Are you currently vaccinated?		
No	878	84.3
Yes	164	15.7
Would you want to be vaccinated for COVID-19?		
No	127	14.5
Yes	751	85.5
What is your plan to receive the vaccine in case it is available?		
Very likely	89	11.8
Likely	178	23.7
Very unlikely	84	11.2
Unlikely	276	36.8
Not sure/do not know	124	16.5
COVID-19 vaccine hesitancy		
No	431	41.4
Yes	611	58.6

Table 2 Reasons for Vaccination Refusal or Hesitancy (N=611)

Reason	True (%)	False (%)
Knows any vaccination place in the district	186 (30.4)	425 (69.6)
Does not know any COVID-19 vaccine	336 (55.0)	275 (45.0)
COVID-19 vaccine will not work	63 (10.3)	548 (89.7)
COVID-19 vaccine will make people infertile	92 (15.1)	519 (84.9)
Government officials should be immunized first	418 (68.4)	193 (31.6)
COVID-19 vaccine will spread COVID-19 virus into my body	89 (14.6)	522 (85.4)
COVID-19 is not a serious illness	51 (8.3)	560 (91.7)
Drinking alcohol protects against COVID-19	181 (31.3)	420 (68.7)
Swallowing antibiotics cures COVID-19	94 (15.4)	517 (84.6)
Eating garlic cures COVID-19	251 (41.1)	360 (58.9)
COVID-19 kills only people with underlying medical conditions	93 (15.2)	518 (84.8)

Discussion

We conducted a study on COVID-19 vaccine hesitancy and its associated factors among 1042 individuals across the four main regions of the country. Of these, 58.6% were reported to be hesitant implying a lower acceptance rate which is in contrast to findings in other countries.[3–10] The study also found substantial regional and residential variations in the COVID-19 vaccination hesitancy among the population.[12,15] Findings show that people in urban areas were less likely to experience vaccination hesitancy compared to their counterparts in the rural areas which correlates with previous studies

Table 3 Multivariate Analysis of COVID-19 Vaccination Hesitancy and the Selected Variables

Variable	cOR [95% CI]	aOR [95% CI]
Age		
18–24	Ref	
25–34	1.06 [0.72,1.56]	
35–44	0.86 [0.57,1.28]	
45–54	0.95 [0.61,1.46]	
55+	1.24 [0.81,1.89]	
Place of residence		
Rural	Ref	
Urban	0.53 [0.41,0.68]***	0.74 [0.55,0.99]*
Region		
Central	Ref	
East	0.71 [0.51,0.97]*	0.66 [0.46,0.95]*
North	0.68 [0.48,0.96]*	0.55 [0.35,0.83]**
West	1.82 [1.26,2.62]**	1.63 [1.07,2.43]*
Sex		
Female	Ref	
Male	0.62 [0.48,0.79]***	0.77 [0.58,1.02]
Education level		
No education	Ref	
Primary	0.57 [0.35,0.93]*	0.72 [0.42,1.22]
Secondary	0.36 [0.22,0.59]***	0.64 [0.36,1.11]
Higher	0.21 [0.13,0.36]***	0.50 [0.27,0.93]*
Working status		
Unemployed	Ref	
Employed	0.91 [0.63,1.31]	
Household size		
1–2	Ref	
3–4	1.67 [1.00,2.82]	1.18 [0.66,2.12]
5+	1.62 [1.01,2.58]*	1.26 [0.74,2.15]
Access to media		
No exposure	Ref	
1 of 3 sources	1.22 [0.79,1.87]	1.37 [0.84,2.21]
2 of 3 sources	0.87 [0.56,1.36]	0.95 [0.56,1.64]
All sources	0.51 [0.32,0.80]**	0.80 [0.44,1.45]
Religion		
Catholic	Ref	
Anglican	1.21 [0.75, 1.94]	
Muslim	1.01 [0.76, 1.35]	
Other	0.84 [0.58, 1.21]	
Marital status		
Single	Ref	
Cohabiting	1.16 [0.77,1.75]	1.17 [0.75,1.84]
Married	1.12 [0.80,1.58]	1.08 [0.74,1.59]
Separated/divorced/widowed	1.99 [1.26,3.16]**	1.34 [0.80,2.23]
Knowledge on the ways of transmitting COVID-19		
No	Ref	
Yes	0.38 [0.28,0.51]***	0.47 [0.34,0.64]***

(*Continued*)

Table 3 (Continued).

Variable	cOR [95% CI]	aOR [95% CI]
Awareness on any COVID-19 vaccine		
No	Ref	
Yes	1.84 [1.43,2.36]***	1.35 [1.01,1.80]

Notes: Ref is a Reference category; cOR is the crude/unadjusted odds ratio; aOR is the adjusted odds ratio, 95% CI is the confidence interval, *$p<0.05$, **$p<0.01$, ***$p<0.001$.

elsewhere.[12] The reason for this could be that access to information and vaccination points is limited among rural people which could partly explain their low uptake.

We also found out that individuals from the eastern or northern region were less likely to be hesitant toward COVID-19 vaccine compared to those in other regions. This regional variation within a country has also been reported in different countries elsewhere.[15] The possible reason could be that information on COVID-19 vaccine had been rolled out in the eastern and northern regions and therefore misconception on the vaccine was low.

In accordance with other studies on COVID-19 vaccination hesitancy[12,15–17] individuals with higher education level were less likely to be hesitant toward the vaccine as compared to their counterparts with low education levels. Educated people are likely to have access to information from all different avenues and therefore are able to make informed decisions compared to those who are not able to read and write. Secondly, education demystifies misconceptions and cultural practices.

Still, having knowledge on the ways of transmitting the virus was significantly associated with lower COVID-9 vaccination hesitancy, which was in line with other findings.[14,17] Schwarzinger et al revealed that having had an experience with COVID-19 such as symptoms or knowing someone with COVID-19 partly prompts more people to take up the vaccination.[15] People who are knowledgeable are empowered in making informed choices compared to those who do not and this could partly explain this finding.

According to the reasons for vaccine refusal and hesitancy reported by the participants, three quarters did not know of any vaccination place in their respective districts while more than half lacked awareness on any vaccine type. Relatedly, many of the respondents were waiting for government officials to be immunized. It was also shown that people believe in swallowing antibiotics or garlic as one of the measures of curing COVID-19, while others believed in drinking alcohol. Still, a significant proportion also have misconceptions that the vaccine can spread the virus in the body, that the virus kills only people with underlying conditions or the vaccine makes people infertile. Others also had doubts on the existence of the virus and the safety of the vaccine itself. Some of these similar reasons of rejecting the vaccine have also been presented in previous studies elsewhere.[6,8,17,18,19,20]

Strength and Limitation

The cross-sectional nature that cannot permit the establishment of causality. Also, the time the survey was done, there could have been limited information about the different types of COVID-19 vaccines and vaccination locations. Therefore, people's vaccination intentions might have changed over time with new information on the vaccines. Nevertheless, this being one of the first few studies that involved physical interaction with the population regarding COVID-19 vaccination truly reflects the factors associated with COVID-19 vaccine hesitancy and the reasons for refusal in Uganda.

Conclusion

The proportion of COVID-19 vaccination hesitancy is still high among the population. Region, place of residence, education level and knowledge about the virus were associated with vaccine hesitancy. The reasons for refusal were attributed to: limited awareness on the vaccination centres and the vaccine brands as well as myths and conceptions on both the virus and the vaccines. The study recommends, mass sensitization of the population on the benefits of vaccination using various channels as well as rolling out community-based outreach vaccination campaigns across the country.

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