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Determinants of Covid-19 Vaccinations among Slum Dwellers: A Case of Katanga, Kampala, Uganda

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Abstract

Coronavirus Disease of 2019 (COVID-19) is caused by the Severe Acute Respiratory Syndrome coronavirus 2(SARS-COV-2). The SARS-COV-2 is a β-coronavirus , which is non-segmented positive-sense RNA virus. The symptoms of COVID-19 may vary. The study was carried out to; examine the individual determinants and socioeconomic determinants and to describe the Health-system determinants of COVID-19 vaccination among Residents of Katanga Slum. The individual determinants were; age between 26 to 35 years (AOR=4.502, CI=1.706-11.886, P=0.002), sex; being of male gender (AOR=2.267, CI=1.316-5.443, P=0.007), marital status; being single (AOR=0.334, CI=0.136-0.820, P=0.017), Being with primary level of education (AOR=17.707, CI=2.393-130.99, P=0.005), occupation; being a peasant (AOR=4.857, CI=1.232-19.14, p=0.024), religion; being a catholic (COR=0.411, CI=0.200-0.846, P-0.016), utilization of health facility for health care (COR=0.047, CI=0.014-0.162, P=0.000) and having a negative attitude towards COVID 19 vaccination (AOR=42.637, CI=320.65, P=0.000). The socio-economic factors were; income (x2=18.861, p=0.000), cost of transport (x2=19.492, p=0.000), cost of vaccination (x2=124.34, p=0.000) and the type of social class of respondents (x2=23.73, p=0.000). In multivariate analysis; only work effect was a determinant of COVID-19 vaccination (AOR=0.327, CI=0.127-0.847 and p=0.021). The health facility determinants were; sensitization (AOR=1.889, CI=1.040-3.431, P=0.037), availability of health workers at facility (AOR=0.211, CI=0.04-0.006, P=0.012), attitudes of health workers (AOR=79.97, CI=11.49-556.3, P=0.000), and Availability of COVID 19 vaccines at the health facility (AOR=0.054, CI=0.006-0.514, P=0.011). The study recommended Increased and continued sensitization for awareness promotion towards the benefits of uptake of COVID-19 vaccination as well as the associated dangers of non-compliance.

Keywords: *COVID-19, Slum Dweller, Severe Acute Respiratory Syndrome Coronavirus, Vaccination.*

Introduction

Coronavirus Disease of 2019 (COVID-19) is caused by the Severe Acute Respiratory Syndrome coronavirus 2 (SARS-COV-2) [1]. On 30 January 2020 following the recommendations of the Emergency Committee, the World Health Organization (WHO), Director-General declared that the outbreak constituted a Public Health Emergency of International Concern (PHEIC) [2]. The SARS-COV-2 is a β-coronavirus, which is non-segmented positive-sense RNA virus [3]. The symptoms of COVID-19 may vary. Common symptoms include mild fever, cough, fatigue, shortness of breath, and myalgia (muscle aches). Anyone can become sick with COVID-19, regardless of age and health status. People above the age of 60 and those with underlying medical conditions are more at risk of getting the severe form of COVID-19. Complications of COVID-19 include severe disease and may lead to death.

Vaccination is a key strategy to prevent the pandemic caused by the COVID-19. [4]. Vaccination is probably the most effective approach to prevent and control COVID-19

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now and in the future. At present, various SARS-CoV-2 vaccines with different characteristics, such as inactivated vaccine, subunit vaccine, DNA vaccine and mRNA vaccine, are under development at different stages. [4] And have been deployed under the WHO emergency use listing. According to the United Nations Children's Fund (UNICEF) and Global Alliance for Vaccines and Immunization (GAVI), in Uganda there has been the importation of Astra Zeneca, Sinovac, Pfizer, Moderna, Johnson and Johnson COVID-19 vaccines are being used to vaccinate Ugandans against COVID-19. [5]. The Ministry of Health (MOH) adds that more than four million people in Uganda have already been vaccinated against COVID 19 but individual determinants, social economic and health facility-based factors still put uptake towards vaccination at stake. [6].

Globally, the outbreak of coronavirus disease (COVID-19) has caused devastation to the entire world. [7] And this disease has rapidly spread in the whole world creating a serious worldwide public health threat. [7]. Although the virus has been under control in China [8], it is still spreading worldwide [9]. As of September 2021, the global burden of COVID-19, there have been over 200 million confirmed cases with over 4 million deaths. In Uganda, there have been over 120 thousand cases with 3170 deaths. (WHO COVID-19 dashboard). The need to limit transmission, and prevent associated problems, and death due to COVID-19 cannot be overemphasized. One proven method of achieving this is through vaccination. [10]. The evidence on the benefits of vaccination on the control of vaccine-preventable diseases speaks for itself. Vaccination is not only beneficial to individuals but also to entire communities in the context of good health and wealth.

The world at large looked at vaccination as one of the most effective ways to prevent and control the impact of COVID-19 for the coming periods in addition to hand washing, social distancing, and wearing of masks. The vaccines that have been introduced have different features such as DNA vaccines, inactivated virus vaccines, sub-unit vaccines mRNA vaccines and others that are still under development in different phases. [9, 11].

In the year 2020 in July, the in-activated SARS-CoV-2 vaccine became approved for use in emergencies for a specific special population in China; moreover, more than 24 million doses of the SARS-COV-2 vaccine were given away in China until early this year 2021. In China, several vaccines have been in use and are currently in use, which include; the China National Biotec Group (CNBG) COVID-19 vaccine and the CoronaVac vaccine developed by China's Sinovac Biotech Ltd. The Ugandan Ministry of Health has received the AstraZeneca vaccine Institute of India (SII) and was transported by UNICEF from India (Mumbai) to Uganda. [12] And also from other countries of the world. Other types of COVID-19 vaccines such as the Pfizer, Corona Vac Janssen vaccine and Moderna, have also been received by the government. According to WHO, countries need to vaccinate at least 70% of their populations to be able to achieve herd immunity. This is still far out of reach with only about 1% compared to the global rate of 34% by the end of September 2021. While vaccine availability has been a main limiting factor affecting access, the COVID-19 vaccination programme has met a lot of resistance from communities.

The overall goals of the COVID-19 vaccination drive are: to reduce pressure on the health systems, reduce the severity and mortality from COVID-19, eliminate the disease and reopening of society's social services that were suspended as part of the none pharmacological measures to control the pandemic (European CDC, 2021). Therefore, people have to accept and receive the vaccines in the whole world. Thus, the need to explore the determinants of COVID-19 vaccination is essential to inform ethical and scientific

decisions for the success of the COVID-19 vaccination campaigns in Uganda shortly. Recent research done in China explored the willingness of young students in China to be vaccinated against COVID-19 and results showed that about 60% of students were willing to be vaccinated. The determinants of vaccination were; socio-economic status and female gender [13]. The limitation of the findings of this study is that it was conducted among young people (mean age =20)who were less likely to get severe COVID-19.

In the United States of America (US), it was found that 69% of the participants were willing to receive a SARS-CoV-2 vaccine. Those who high chance of getting severe COVID-19 had a chance of receiving the vaccine [14]. Vaccine-related attributes and vaccine efficacy were associated with their willingness to receive vaccination in the US. [15]. Many other factors were identified such as education level, knowledge or awareness on vaccines were also associated with willingness to receive the vaccines. [16, 17].

In Uganda, the launch of the first phase of the COVID-19 vaccination exercise started in March 2021, this launch was held at Mulago National Referral Hospital. During the launch, it was clear that much effort is needed to make the public accept the vaccine to ease pressure on the health system, reduce disease severity and deaths, and reopen social services such as schools. Some public service officials had to take the COVID-19 vaccine publicly to assure the public of the safety of the vaccine. [18]. The COVID-19 pandemic has been met with varying perceptions ranging from negative to positive perceptions among the public. The over-abundance of information about the disease, which comprises both right, and wrong information has contributed to varying perceptions in the community, which can yield both positive or negative effects on the willingness to uptake the COVID-19 vaccine. [19]. This pandemic of misinformation that has been termed “infodemic” by the WHO has affected the willingness of communities to receive the COVID-19 vaccine.

Few studies [20, 21] these have been done to assess the willingness of the public to receive the SARS-CoV-2 vaccine in Uganda and mainly they have been online surveys that did not involve randomization and did not assess the factors associated with the acceptability of the COVID-19 vaccine.

Uganda was targeting to vaccinate 20% of the population but five months down the road, only 0.8% of the population has been fully vaccinated compared to the global vaccination rate of 32.3% as of September 2021 [22]. In Uganda, some health workers who are supposed to be influencers of the society to receive the COVID-19 vaccine have not been willing to get vaccinated while to a certain extent, some went further to de-campaign the exercise, and the problem could be worse in the general public.

There is a growth of mistrust among the public in Uganda [23] on vaccines since many people have different perceptions and knowledge [24]. The government and Ministry of Health have awareness campaigns on TV and radio but many people have opted for local remedies rather than the vaccine and yet these have not been medically approved [25]. One study in western Uganda revealed that men were not willing to accept the vaccine because they perceived that it had a risk to male sexuality [20]. The study concentrated on the vast entirety of the computer literate class in western Uganda but could have even involved residents of other Ugandan regions or even outside Uganda and not specific to local populations in the Katanga slum that have specific socio and cultural interactions, various studies have significantly linked individual determinants, social economic and health facility-based factors to low uptake of COVID 19 vaccination. The study used online snowball convenience sampling where the study could have been biased by the fact that the researcher had no control over which people could be

interviewed for the study. Also, people who had no access to the internet or with limited literacy levels were excluded unlike the study that will be done in Katanga that will cater for all these populations, thus being more representative and generalizable. The unwillingness of the people to accept the COVID-19 vaccine could lead to increased severe COVID-19 infections requiring hospitalization putting pressure on the health system with preventable deaths and also leading to delays in social life normalization.

Therefore, this study was carried out to assess the individual, socio-economic, and health system determinants of COVID-19 vaccination among Residents of Katanga Slum.

Materials and Methods

Research Design

This was a mixed methods study that employed both quantitative and qualitative methods of data collection. For the quantitative aspects of the study, a cross-sectional study design was conducted. A cross-sectional study design is a type of observational study design where the investigator measures the exposure and outcome among study participants at the same point in time. (Setia, 2016). This design was used at the community level because it was relatively faster and less expensive than other study designs. The qualitative aspect entailed the use of Key informant interviews with health workers of Mulago National Referral Hospital who were more knowledgeable on the subject of COVID-19 vaccines.

Study Area

The study was conducted in Katanga Slum. Katanga Slum is a settlement located in the valley between Mulago Hospital and Makerere University, in Uganda's capital city, Kampala. Katanga slum is located in Kawempe Division. It is bordered by Bwaise to the north, Mulago to the east, Wandegeya to the west, and Nakasero to the south.

Katanga slum stretches about 1.5 kilometres from Wandegeya to Kubiri, near Bwaise. Katanga is divided into two administrative Local Council 1 zones, "Busia zone" and "Kimwanyi zone". It is developed with students' hostels as viewed from Wandegeya, and temporary structures built with timber or mud and bricks. The temporary structures are mostly close to Mulago Hospital. Katanga was selected because it's one of the slum areas in Uganda and near the biggest National Referral Hospital in Uganda which provides COVID-19 vaccination services.

Study Population

Burns (1997) defined a population as either the total number of potential units for observation or an entire group of people, objects, or events having at least one variable. The study population involved all the residents of the Katanga Slum in Kampala who were 18 years and above and health workers from Mulago National Referral Hospital (COVID-19 vaccination teams).

Inclusion

1. The study included all people aged 18 years and above.

Exclusion Criteria

1. The study excluded all those people who were not found at home during the time of interviews.
2. People who had communication disabilities and those with mental illness were excluded.
3. People who were too sick to participate were also excluded from this study.
4. Those who did not consent to the study

Sample Size

The sample size for this study is computed using Kish's formula [26].

$$n = \frac{Z^2 PQ}{d^2}$$

Where;

n- Sample size.

Z- The standard normal value corresponding to the 95% confidence level; z = 1.96.

P- The proportion of the population that would accept the COVID vaccine is not known and it is assumed to be 50%; P= 50%, Q; 100% - P.

d- The precision (acceptable degree of error for cross-sectional studies) is 5%

Therefore, $n = \frac{1.962 * 0.5 * (0.5)}{0.05 * 0.05}$

= 384 respondents

The researcher expected a non-response rate of 10% and therefore the sample size was computed to include the non-response of 10%

$= (10/100) * 384 = 38.4 = 38$

Therefore, the study was to involve 422 respondents to participate in the study (384+38), but the questionnaires with completeness were 314.

However, the sample size for the qualitative study was recruited based on the recommendation by Creswell. [27]. Creswell recommends a sample size of 5 to 25 for qualitative studies or until saturation of the main theme is attained. Therefore, this study interviewed respondents until saturation of the main themes was attained.

Data Collection Techniques and Tools

For the cross-sectional study, Interviewer administered semi-structured questionnaires were administered to collect data on the determinants of COVID-19 vaccination among residents in the Katanga slum.

For qualitative data collection, a key informant guide was used to collect data from the local leaders' LCs. This had open questions related to the study objectives. It was also arranged in sections according to the objectives of the study.

Data Analysis Plan and Statistical Tests

The willingness of residents to be vaccinated was presented in the form of frequencies, percentages, mean and standard deviation. The categorical variables including marital status, educational level, and occupation were also presented as frequencies and percentages.

In order to measure objective 2, the data was analyzed first of all to get to know the descriptive statistics of the respondents. Thereafter, cross-tabulation was run between the economic factors and COVID-19 vaccination in order to ascertain the frequencies from each category and the percentage of those who were willing to uptake the vaccines.

Bivariate analysis was also carried out such as the use of a chi-square test to measure the relationship between individual, social economic and health system determinants with COVID-19 vaccination. This was tested at a 95% confidence interval and those factors with $P<0.05$ were considered statistically significant factors associated with the dependent variable. This also applied to objective 3. Similar tests were run to ascertain the health system determinants of COVID-19 vaccination.

Qualitative Data Analysis

After data collection, recorded data from interviews was transcribed, after checking for completeness and consistency as well as for various omissions, incomplete or otherwise unusual responses. Data analysis was done manually focusing on the major themes from the transcript's thematic analysis. Qualitative data was presented in the form of statements and narratives to support the findings from the quantitative study.

Results

Individual Determinants of COVID-19 Vaccination among Residents of Katanga Slum

Table 1. Demographic Data of Respondents

n=314

Variable	Frequency	Percentage %
Gender (n=314)		

Male	118	37.6
Female	196	62.4
Age (n=314)		
18-25 years	81	25.8
26-35 years	129	41.1
36 years and above	104	33.1
Education (n=314)		
None	30	9.6
Primary	204	65.0
Secondary	64	20.4
Tertiary	16	5.1
Occupation (n=314)		
Peasant	14	4.5
Business	200	63.7
Private employee	60	19.1
Civil servant	40	12.7
Religion (n=314)		
Moslem	72	22.9
Catholic	146	46.5
Anglican	82	26.1
Others	14	4.5
Marital Status (n=314)		
Single	78	24.8
Married	209	66.6
Divorced	14	4.5
Widowed	13	4.1
Health facility utilization		
Yes	216	69.2
Not always sometimes I practice self-medication	35	11.2
Never, I believe in traditional herbal medicine	61	19.6
Attitudes towards COVID-19 vaccination		
Negative	88	29.5
Positive	210	70.5
Ever suffered from COVID 19		
No	224	72.5
Yes	85	27.5

Results from

Table 1 Show the socio-demographic characteristics of respondents who participated in the study. Results from the study show that the majority 196(62.4%) were females while 118 (37.6%) were males.

According to the age distribution of the respondents, the majority 129 (41.1%) were 26 years old up to 35 years, followed by those aged 36 years and above 104 (33.1%) and 81 (25.8%) respondents were aged 18 to 25 years old.

According to education, the majority 204(65%) had attained primary level of education, followed by 64(20.4%) who had attained secondary level of education and few people had attained tertiary level of education 16(5.0%). This study also showed that there were 30 (9.6%) of the respondents who had no education level/had not gone to school. As known to Uganda, Katanga is a slum and slum areas are associated with people with low education levels. Therefore, the study revealed that overall; there was a low level of education among Katanga residents.

The current study also assessed the occupation level; it was revealed that the majority 200(63.7%) of the participants were engaged in businesses for an income, followed by private employees 60 (19.1%), and few civil servants 40 (12.7%) and 14 (4.5%) peasants.

Results also showed that the majority 146(46.5%) were Catholics by religion, followed by 82 (26.1%) Anglicans, 72 (22.9%) Muslims and 14(4.5%) belonged to other religious affiliations. The majority 209 (66.6%) of the participants were married, 78(24.8%) were single and a few had divorced 14(4.5%) and others were widows 13 (4.1%).

In conclusion demographics therefore most respondents were aged 26-35 years followed by those who were aged 18-25 years, which indicates that these are economically active individuals still with energy to work and were likely to be engaged in active income-generating activities and likely to miss out uptake COVID 19 vaccination. Most of them had low levels of education, which may imply that they have little knowledge of COVID-19 services.

This study also revealed that the majority 216(69.2%) of the Katanga residents utilized health facilities for access to human-based care, 61 (19.6%) never utilized health facilities and believed in the use of traditional herbal medicines while 35(11.2%) sometimes practised self-medication.

The study also assessed the attitudes of the participants towards COVID-19 vaccination. Results showed that the majority 210(70.5%) had a positive attitude towards vaccination. This assesses the willingness of the people to be vaccinated against COVID-19. However, 88(29.5%) had negative attitudes towards COVID-19 vaccination. Therefore, the willingness of the people to be vaccinated was 70.5%.

Results also on individual factors revealed that the majority 224(72.5%) had never suffered from COVID-19 during the pandemic and 85(27.5%) of the participants had suffered from COVID-19. This shows the rate of infection of the coronavirus. Among the study participants, it's visible that the coronavirus affected Ugandans.

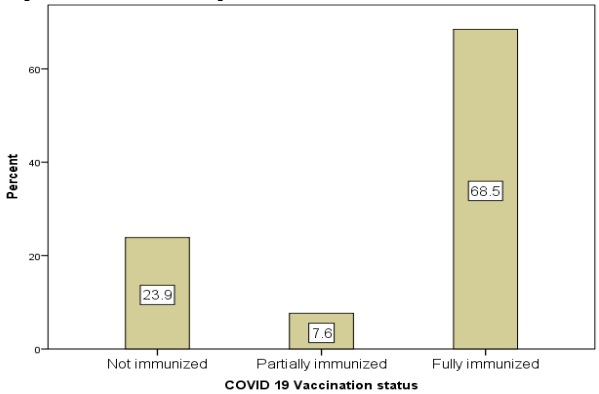

Figure 1. COVID-19 Vaccination Status among Participants

Results from Figure 1 Show that the majority 215(68.5%) of the participants from Katanga had been fully vaccinated against the COVID-19 vaccine, 75 (23.9%) had not been vaccinated and 24 (7.6%) had partially been vaccinated.

Table 2. Reasons for Vaccination Status of Participants

Reason for the status of vaccination	**Frequency**	**Per cent**
Not willing	83	27.2
2nd dose is not due	6	2.0
I fell out because I was discouraged by somebody about the associated dangers	56	18.4
I was willing to take it up	158	51.8
Busy work schedule	2	.7
Total	**305**	**100.0**

From **Table 2**, the majority 158(51.8%) were willing to take up the vaccination, and 83(27.2%) were not willing to take up the COVID-19 vaccine. This means that an additional 8 participants who had received partially the COVID-19 vaccine were not willing to complete the vaccine. 56(18.4%) of those who were partially vaccinated also fell out because they were discouraged by some people about the dangers associated with the vaccine.

Table 3. Bivariate Pearson Chi-square Results of Individual Determinants of COVID-19 Vaccination among Residents of Katanga Slum

Individual Factors		**COVID 19 vaccination status**		χ^2	***df***	**P-Value**
		Vaccinated N (%)	**Unvaccinated N (%)**			
Gender	Male	86 (72.9)	32(27.1)	1.087[a]	1	.299
	Female	153 (78.1)	43(21.9)			
Age	18-25	59 (72.8)	22(27.2)	13.624[a]	1	**.001**
	26-35	88 (68.2)	41(31.8)			
	36 and above	92 (88.5)	12(11.5)			
Education	Not at all	25 (8.0)	5(1.6)	25.218[a]	1	**.000**
	Primary	138 (43.9)	66(21.0)			
	Secondary	62 (19.7)	2(0.6)			
	Tertiary	14 (4.5)	2(0.6)			
Occupation	Peasant	8 (2.5)	6(1.9)	14.865[a]	1	**.002**
	Business	163 (51.9)	37(11.8)			
	Private sector	36 (11.5)	24(7.6)			
	Civil servant	32 (10.2)	8(2.5)			
Religion	Muslim	57 (18.2)	15(4.8)	16.879[a]	1	**.001**
	Catholic	118 (37.6)	28(8.9)			
	Anglican	50 (15.9)	32(10.2)			
	Others	14 (4.5)	-			
	Yes	212 (67.9)	4(1.3)	239.45[a]	1	**.000**

Utilization of HF	Not always	25 (8.0)	10(3.2)			
	Use traditional Med	2 (0.6)	59(18.9)			
Attitudes towards vaccination	Negative	22 (7.4)	66(22.1)	193.07[a]	1	**.000**
	Positive	208 (69.8)	2(0.7)			
Infected (COVID 19)	Yes	64 (20.7)	21(6.8)	0.076[a]	1	**-0.016**
	No	172 (55.7)	52(16.8)			

The results in

Table **3** Are from cross-tabulation to ascertain the existence of a relationship between individual factors and COVID-19 vaccination. From the results of the study, age (x^2=13.624, p=0.001), education (x^2=25.218, p=0.000), occupation (x^2=14.865, p=0.002), religion (x^2=16.879, p=0.001), place of access for medical care (x^2=239.45, p=0.000), attitudes towards vaccination (x^2=193.07, p=0.000) and having been infected with coronavirus (x^2=0.076, p=-0.016) were the factors found to be significantly associated with COVID 19 vaccination. This means these were the individual determinants associated with COVID-19 vaccination.

However, the findings were found with a p-value less than 0.2 and were again subjected to logistic regression to find out the true individual-related determinants of COVID-19 vaccination.

Table 4. Bivariate and Multivariate Logistic Regression Results for the Association between Individual Factors and COVID-19 Vaccination

Individual Factors		**COVID 19 vaccination status**		**COR (95% C.I.)**	**p-Value**	**AOR (95% C.I.)**	**p-Value**
		Vaccine. N (%)	**Unvaccin. N (%)**				
Gender	Male	86(72.9)	32(27.1)	1.32(.78-2.25)	0.298	**2.27(1.32-5.44)**	**0.007**
	Female	153(78.1)	43(21.9)	1			
Age	18-25	59(72.8)	22(27.2)	0.800(.433-1.479)	0.477	2.010(0.847-4.768)	0.113
	26-35	88(68.2)	41(31.8)	**2.859(1.32-6.21)**	**0.008**	**4.50(1.71-11.89)**	**0.002**
	36 +	92(88.5)	12(11.5)	1			
Marital status	Single	66(21.0)	12(3.8)	**0.473 (0.238-0.94)**	**0.032**	**0.334 (0.136-0.820)**	**0.017**
	Married	151(48.1)	58(18.5)	1.091(0.216-5.50)	0.916	0.208(0.031-1.410)	0.108
	Divorced	12(3.8)	2(0.6)	0.606(0.145-2.53)	0.492	0.278(0.050-1.550)	0.144
	Widowed	10(3.2)	3(1.0)	1			
Education	Not at all	25(8.0)	5(1.6)	0.418(0.153-1.14)	0.089	0.680(0.209-2.207)	0.521

	Primary	138(43.9)	66(21.0)	**6.2(1.128-34.085)**	**0.036**	**17.707(2.3-130.99)**	**0.005**
	Secondary	62(19.7)	2(0.6)	1.4(0.240-8.182)	0.709	3.571(0.449-28.39)	0.229
	Tertiary	14(4.5)	2(0.6)	1			
Occupation	Peasant	8(2.5)	6(1.9)	**3.304(1.08-10.10)**	**0.036**	**4.857(1.232-19.14)**	**0.024**
	Business	163(51.9)	37(11.8)	1.125(0.346-3.65)	0.845	2.694(0.599-12.12)	0.196
	Private sector	36(11.5)	24(7.6)	3.0(0.808-11.138)	0.101	2.228(0.439-11.30)	0.334
	Civil servant	32(10.2)	8(2.5)	1			
Religion	Muslim	57(18.2)	15(4.8)	1.109(0.549-2.24)	0.773	1.061(0.455-2.48)	0.890
	Catholic	118(37.6)	28(8.9)	**0.411(0.2-0.846)**	**0.016**	0.395(0.134-1.162)	0.092
	Anglican	50(15.9)	32(10.2)	1		-	
	Others	14(4.5)	-	1			
Utilization of HF	Yes	212(67.9)	4(1.3)	**0.047(0.014-0.16)**	**0.000**	0.700(0.122-4.028)	0.689
	Not always	25(8.0)	10(3.2)	**0.001(0.00-0.004)**	**0.000**	-	
	Traditional Med	2(0.6)	59(18.9)	1		1	
Attitudes towards vaccination	Negative	22(7.4)	66(22.1)	**312(71.5-1362.1)**	**0.000**	**42.64(5.67-320.65)**	**0.000**
	Positive	208(69.8)	2(0.7)	1			
Infected with Corona Virus	Yes	64(20.7)	21(6.8)	0.921(0.515-1.65)	0.783	1.120(0.407-3.081)	0.820
	No	172(55.7)	52(16.8)	1			

The results in

Table **4** Show the bivariate and Multivariate Logistic regression results for the association between individual factors and COVID-19 vaccination. From the COR; factors such as age between 26 to 35 years (COR=2.859, CI=1.316-6.209, P=0.008) were found to influence COVID-19 vaccination. In multivariate analysis, the age of 26 to 35 years was found to have an influence on COVID-19 vaccination with AOR=4.502, CI=1.706-11.886, P=0.002. This means that people who were aged 26 to 35 years of age were about 4.502 times more likely to get vaccinated than other age groups.

In multivariate analysis, gender was found to be associated with COVID-19 vaccination. Being of male gender was associated with COVID-19 vaccination with (AOR=2.267, CI=1.316-5.443, P=0.007). This meant that males were 2.267 times more likely to get vaccinated than females. This means that males stand a higher chance of being vaccinated against COVID-19 than females.

Being single was found to have an association with COVID-19 vaccination in both bivariate and multivariate analysis with COR=0.473, CI=0.238-0.940, P=0.032 and AOR=0.334, CI=0.136-0.820, P-0.017 respectively. Being single was associated with 0.334 chances of not being vaccinated against COVID-19. This meant that single people had higher chances of being vaccinated than other marital statuses.

Being with a primary level of education was found to have an influence on COVID-19 vaccination with COR=6.2, CI=1.128-34.085, P= 0.036 and AOR=17.707, CI=2.393-130.99, P=0.005**.** This meant that having a primary level of education increased the chances of COVID-19 vaccination by 17.707 times more than other education levels. Primary holders stood about 17.707 times more likely to be vaccinated against COVID-19 than other education levels.

The results of the study also revealed that being a peasant was associated with COVID-19 vaccination with COR=3.304, CI=1.081-10.097, P=0.036 and AOR=4.857, CI=1.232-19.14, p=0.024. The results of the study also showed that peasants were 4.857 times more likely to be vaccinated against COVID-19 than other occupation categories.

Social Economic Determinants of COVID-19 Vaccination among Residents of Katanga Slum

At bivariate analysis, being a catholic was found to be associated with COVID-19 vaccination with COR=0.411, CI=0.200-0.846, P-0.016. The study also revealed that Catholics were 0.411 times more likely to get vaccinated against COVID-19 than other religions.

Results from individual factors also showed that utilization of health facilities for health care was associated with COVID 19 vaccination (COR=0.047, CI=0.014-0.162, P=0.000) and sometimes the utilization of health facilities for health care (COR=0.001, CI=0.000-0.004, p=0.000). This means that those who accessed healthcare services from health facilities and sometimes, were more likely to get vaccinated against COVID-19 than those who utilized traditional herbs.

This study also revealed that having a negative attitude towards COVID-19 vaccination had an influence on the vaccination status of the people. Results from bivariate and multivariate logistic regression revealed the following results: COR=312, CI=71.466-1362.09, P=0.000 & AOR=42.637, CI=320.65, P=0.000. Results showed that people with negative attitudes towards COVID-19 vaccination were 42.637 times less likely to get vaccinated.

Table 5. Pearson Chi-square Results of Individual Determinants of COVID-19 Vaccination among Residents of Katanga Slum

Individual Factors		**COVID 19 vaccination status**		χ^2	***df***	**P-Value**
		Vaccinated N (%)	**Unvaccinated N (%)**			
Income	<101,000	72(24.1)	36(12.0)	18.861[a]	1	**.000**
	101,000-300,000	38(12.7)	4(1.3)			
	Above 300,000	129(43.1)	20(6.7)			
Family size	1-3	132(44.1)	38(12.7)	1.438 [a]	1	.487
	4-6	73(24.4)	14(4.7)			
	Above 6	34(11.4)	8(2.7)			
Income adequacy	Yes	86(30.0)	14(4.9)	3.669[a]	1	.055
	No	143(49.8)	44(15.3)			

Reason for vaccine	Fearing death	204(69.4)	54(18.4)	2.614[a]	1	.271
	Willingly	24(8.2)	2(0.7)			
	Policy	8(2.7)	2(0.7)			
Distance	500m -1km	235(74.8)	71(22.6)	3.079[a]	1	.079
	More than 1km - 2km	4(1.3)	4(1.3)			
Cost of transport	1000-5000	239(76.1)	69(22.0)	19.492[a]	1	**.000**
	Not Applicable	-	6(1.9)			
COVID vaccine costs	Free of charge	239(78.9)	34(11.2)	124.34[a]	1	**.000**
	Above 30000	-	4(1.3)			
	Not applicable	-	26(8.6)			
Work effect	No	207(71.6)	38(13.1)	3.607[a]	1	.058
	Yes	32(11.1)	12(4.2)			
Social class	Low social class	148(49.8)	57(19.2)	23.73[a]	1	**0.00**
	Elite	89(30.0)	3(1.0)			

The results in

Table **5** Are from cross-tabulation to ascertain the existence of a relationship between socioeconomic factors and COVID-19 vaccination. From the results of the study, income (x^2=18.861, p=0.000), cost of transport (x^2=19.492, p=0.000), cost of vaccination (x^2=124.34, p=0.000) and the type of social class of respondents (x^2=23.73, p=0.000) were the socio-economic factors found to be statistically significant with COVID 19 vaccination status. This means these were the socio-economic determinants associated with COVID-19 vaccination.

However, the findings found with a p-value less than 0.2, were again subjected to logistic regression to find out the true socio-economic determinants of COVID-19 vaccination.

Table 6. Bivariate and Multivariate Binary Logistic Regression for Socio-economic Determinants of COVID-19 Vaccination

Individual Factors		**COVID 19 vaccination status**		**COR(CI)**	***P-Value***	**AOR(CI)**	**P-value**
		Vaccine. N (%)	**Unvaccin. N (%)**				
Income	<101,000	72(24.1)	36(12.0)	**4.75(1.573-14.345)**	**0.006**	1.622(0.486-5.416)	0.432
	101,000-300,000	38(12.7)	4(1.3)	**3.225(1.738-5.983)**	**0.000**	2.884(0.954-8.722)	0.061
	Above 300,000	129(43.1)	20(6.7)	1			
Income adequacy	Yes	86(30.0)	14(4.9)	0.529(0.274-1.022)	0.058	0.891(0.322-2.462)	0.823
	No	143(49.8)	44(15.3)	1			
Distance	500m - 1km	235(74.8)	71(22.6)	0.302(0.074-1.239)	0.096	0.169(0.023-1.222)	0.078

	More than 1km -2km	4(1.3)	4(1.3)	1			
Work effect	No	207(71.6)	38(13.1)	0.490(0.232-1.034)	0.061	**0.327(0.127-0.847)**	**0.021**
	Yes	32(11.1)	12(4.2)	1			
Social class	Low social class	148(49.8)	57(19.2)	**11.426(3.475-37.571)**	**0.012**	2.633(0.609-11.386)	0.195
	Elite	89(30.0)	3(1.0)				

From the results above in

Table **6** Having an income of less than 101,000 Uganda shillings influenced COVID-19 vaccination (COR=4.75, CI=1.573-14.345, P=0.006) and having an income between 101,000 to 300,000 Uganda shillings also influenced COVID-19 vaccination (COR=3.225, CI=1.738-5.983, P=0.000). Results mean that those who earned income less than 101,000 were 1.573 times more likely to get vaccinated against COVID 19 and those who earned income between 101,000 to 300,000 Uganda shillings were also 3.225 times more likely to get vaccinated.

The results also showed that having no work-related effect/issue was associated with COVID-19 vaccination with AOR=0.327, CI=0.127-0.847 and p=0.021. This showed that having no work pressure was associated with COVID-19 vaccination. This meant that those without any work-related effects were 0.327 times more likely to get vaccinated against COVID-19 than those with work effects.

The study also revealed that being of low social class was associated with COVID-19 vaccination (COR=11.426, CI=3.475-37.571, P=0.012). This meant that people with low social class in Katanga, Kampala were about 11.426 times more likely to get vaccinated than those of the elite class.

Health System Determinants of COVID-19 Vaccination among Residents of Katanga Slum

Table 7. Pearson Chi-square Analysis of the Health System Factors and COVID-19 Vaccination

Health System Factors		**COVID 19 vaccination status**		χ^2	***df***	**P-Value**
		Vaccinated N (%)	**Unvaccinated N (%)**			
Sensitization	Yes	194(66.2)	22(7.5)	37.165[a]	1	**.000**
	No	45(15.4)	32(10.9)			
Waiting time	<30 mins	50(17.1)	12(4.1)	146.195[a]	3	**.000**
	30mins-2 hrs	115(39.2)	8(2.7)			
	> 2hrs	72(24.6)	6(2.0)			
	N/A	-	30(10.2)			
Health workers	One	16(5.3)	-	229.66[a]	3	**.000**
	Two	45(14.9)	2(0.7)			
	3 & more	166(55)	-			
	I don't know	12(4.0)	61(20.2)			

Privacy	Yes	15(4.8)	-	271.58[a]	3	**.000**
	Not really	212(67.5)	4(1.3)			
	Sometimes	8(2.5)	-			
	I don't know	4(1.3)	71(22.6)			
HW Availability	Yes	231(74.3)	6(1.9)	256.93[a]	2	**.000**
	No	4(1.3)	-			
	I do not know	4(1.3)	66(21.2)			
Attitude of HW	Good	231(76.2)	6(2.0)	256.3[a]	3	**.000**
	Fair	4(1.3)	-			
	Bad	2(0.7)	-			
	I do not know	2(0.7)	58(19.1)			
Vac. availability	Yes	233(77.7)	8(2.7)	232.98[a]	2	**.000**
	No	4(1.3)	22(7.3)			
	I don't know	-	33(11.0)			
Essential available.	Yes	233(75.9)	6(2.0)	251.29[a]	2	**.000**
	No	2(0.7)	-			
	I don't know	4(1.3)	62(20.2)			
Cost incurred	Yes	20(6.5)	2(0.6)	187.25[a]	2	**0.000**
	No	209(67.4)	12(3.9)			
	I don't know	10(3.2)	57(18.4)			

From the results of the study in

Table 7, sensitization (x^2=37.165, p=0.000), waiting time (x^2=146.195, p=0.000), number of present health workers (x^2=229.66, p=0.000), privacy during COVID 19 vaccination (x^2=271.58, p=0.000), availability of health workers at the health facility (x^2=256.3, p=0.000), attitudes of health workers (x^2=256.3, p=0.000), availability of vaccines (x^2=232.98, p=0.000), availability of essential items for COVID 19 vaccination (x^2=251.29, p=0.000) and additional costs incurred at facility for COVID 19 vaccination (x^2=187.25, p=0.000) were the health system factors associated with COVID 19 vaccination among people in Katanga.

However, the analysis where the p-value was less than 0.2 was subjected to logistic regression analysis as both bivariate and multivariate to ascertain the Crude odds ratio (COR) and the Adjusted odds ratio (AOR).

Table 8. Bivariate and Multivariate Logistic Regression of Health System Factors and COVID-19 Vaccination

Health System Factors		**COVID 19 vaccination status**		**COR(CI)**	**P-value**	**AOR**	**P-value**
		Vaccine. N (%)	**Unvaccin. N (%)**				
Sensitization	Yes	194(66.2)	22(7.5)	**0.159(0.085-0.3)**	**0.000**	**1.889(1.040-3.431)**	**.037**
	No	45(15.4)	32(10.9)	1		1	-
Waiting time	<30 mins	50(17.1)	12(4.1)	**3.45(1.33-8.96)**	**0.011**	1.535(.905-2.606)	.112
	30mins-2 hrs	115(39.2)	8(2.7)	**2.88(1.01-8.18)**	**0.047**	.707(.408-1.226)	.217

	> 2hrs	72(24.6)	6(2.0)	1			
	Not applicable	-	30(10.2)	1			
Availability of HWs	Yes	231(74.3)	6(1.9)	1.349(.944-2.108)	.072	**0.211(0.04-0.006)**	**0.012**
	No	4(1.3)	-	**0.002(0.00-0.006)**	**0.000**		
	I do not know	4(1.3)	66(21.2)	1			
Attitude of health Wor	Good	231(76.2)	6(2.0)	1.186(.508-2.771)	.693	**79.97(11.49-556.3)**	**0.000**
	Fair	4(1.3)	-	1.530(.731-3.205)	.259		
	Bad	2(0.7)	-	**0.001(0.000-0.005)**	**0.000**	**1**	
	I do not know	2(0.7)	58(19.1)	1			
Vaccine availability	Yes	233(77.7)	8(2.7)	**0.006(0.002-0.022)**	**0.000**	**0.054(0.006-0.514)**	**0.011**
	No	4(1.3)	22(7.3)				
	I don't know	-	33(11.0)				
Essential availability	Yes	233(75.9)	6(2.0)				
	No	2(0.7)	-	**0.002(0.00-0.006)**	**0.000**		
	I don't know	4(1.3)	62(20.2)				
Any cost incurred	Yes	20(6.5)	2(0.6)	1.742(0.364-8.335)	0.487		
	No	209(67.4)	12(3.9)	**0.018(0.004-0.087)**	**0.000**		
	I don't know	10(3.2)	57(18.4)				

Results in

Table **8** Above are the findings from Bivariate and multivariate logistic regression. The results showed that being sensitized was associated with COVID-19 vaccination with COR=0.159, and P-Value=0.000. In multivariate analysis, it was also found out at multivariate analysis that being sensitized was associated with COVID-19 vaccination (AOR=1.889, CI=1.040-3.431, P=0.037). Therefore, this study found out that people who were sensitized about COVID-19 vaccination were 1.889 times more likely to get vaccinated against COVID-19 than those who were not vaccinated.

Results also showed that waiting time of less than 30 minutes at the facility and waiting time of 30 minutes to 2 hours had an influence on COVID-19 vaccination with COR=3.45, CI=1.33-8.96, P=0.011 and COR=2.88, CI=1.01-8.18, P=0.047 respectively. This showed that people who waited for less than 30 minutes at the health facility were more likely to get vaccinated than those also who waited between 30 minutes and up to 2 hours.

The study also revealed that the availability of health workers at the health facility influences COVID-19 vaccination. There was a statistically significant relationship between the availability of health workers at the facility and COVID-19 vaccination (AOR=0.211, CI=0.04-0.006, P=0.012). This study revealed that the availability of health workers at the health facility was 0.211 times more likely to increase COVID-19 vaccination rates at the facility.

Results from the study also showed that good attitudes of health workers influence COVID-19 vaccination (AOR=79.97, CI=11.49-556.3, P=0.000). This means that the presence of health workers with good attitudes expressed to clients was associated with increased COVID-19 vaccination of about 79.97 times.

Availability of COVID-19 vaccines at the health facility was also found to influence COVID-19 vaccination among residents of Katanga, Kampala, Uganda (AOR=0.054, CI=0.006-0.514, P=0.011). This means that availability of COVID-19 vaccines increases COVID-19 vaccination among people by 0.054 times.

In bivariate analysis, results showed that lack of essential items for use during vaccination influenced COVID-19 vaccination among people (COR=0.002, CI=0.000-0.006, P=0.000). This means that the lack of essentials for COVID-19 vaccination is more likely to reduce COVID 19 vaccination by about 0.002 times. The results also showed that having no additional cost incurred on COVID 19 vaccination among people was associated with COVID 19 vaccination (COR=0.018, CI=0.004-0.087, P=0.000). Having no additional cost to incur in COVID 19 vaccination at the facility increased COVID 19 vaccination by about 0.018 times.

Discussion

Demographic Determinants for COVID-19 Vaccination

This study revealed that the age of 26 to 35 years was associated with COVID 19 vaccination. This shows that age influences vaccination. Similarly, a study done in Philadelphia to find out the factors associated with willingness to receive the COVID-19 vaccines found that age was a significant factor associated with willingness to receive the COVID-19 vaccine. [28]. However, the findings in this current study showed that people aged 26 to 35 years were more likely to receive the COVID-19 vaccines than the study by Browne which reported that those who were 65 years older and above were more willing to receive the vaccine. [29]. This could have been due to the fact that the highest number of people who participated in this study were between 26 to 35 years old.

This study also revealed that gender was associated with COVID-19 vaccination more specifically being of male gender. Males were 2.267 times more likely to get vaccinated than females. This means that males stand a higher chance of being vaccinated against COVID-19 than females. These findings agree with studies done in the Democratic Republic of Congo (DRC), by Nzaji et al. (2020)[30] and Saudi Arabia by Qattan et al. (2021)[31] Which also showed that COVID 19 vaccination was influenced by sex. However, the findings of this study showed that males were more likely to get vaccinated than females which disagrees with other studies that showed that females were more likely to get vaccinated than males. However, the results of this study involved more females than males, which could be the reason why the findings are this way.

Similar to the current study findings, another study done among healthcare workers in Israel also showed that sex is a predictor of willingness to receive the COVID-19 vaccine. This study found that males had a high chance of accepting the vaccine against COVID-19. The study concluded that there is a positive association between male sex and acceptance of COVID-19 vaccination. [32]. Similarly, [33] Found in their study done in Uganda that males

were 1.1 times more likely to accept the COVID-19 vaccine than females.

A study done in Nepal showed that males had higher perception scores regarding COVID-19 vaccines. [34]. In a US study conducted among the adult population, males were more willing to be vaccinated than were females. [35]. In a similar study conducted among healthcare workers in Saudi Arabia, males were 1.55 times more willing than females to be vaccinated. [36]. It also documented that males are more vulnerable to severe disease and mortality possibly because the testes harbour the virus and delay viral clearance. [37].

Being single was found to have an association with COVID-19 vaccination in both bivariate and multivariate analysis with COR=0.473, CI=0.238-0.940, P=0.032 and AOR=0.334, CI=0.136-0.820, P-0.017 respectively. Being single was associated with 0.334 chances of COVID-19 vaccination among people. This meant that single people had higher chances of being vaccinated than other marital statuses. The findings of this study agree with findings by Kanyike done in Uganda which showed that singles were more willing to get vaccinated than married ones [38]. The findings of this study agree with those by Wang done in China which revealed that marital status was associated with willingness to receive the COVID-19 vaccine [39].

Being with a primary level of education was found to have an influence on COVID-19 vaccination with COR=6.2, CI=1.128-34.085, P= 0.036 and AOR=17.707, CI=2.393-130.99, P=0.005. This meant that having a primary level of education increased the chances of COVID-19 vaccination by 17.707 times than other education levels. Primary holders stood about 17.707 times more likely to be vaccinated against COVID-19 than other education levels. This current study found that willingness was higher among residents who had a primary level of education than those who had not been educated no formal education at all, the reason could be because those with a primary level of education could easily discern wrong versus wrong information regarding COVID 19 vaccination as was cited in other studies. [40].

The results of the study also revealed that being a peasant was associated with COVID-19 vaccination with COR=3.304, CI=1.081-10.097, P=0.036 and AOR=4.857, CI=1.232-19.14, p=0.024. The results of the study also showed that peasants were 4.857 times more likely to be vaccinated against COVID-19 than other occupation categories. Employment status has been found to influence COVID-19 vaccination. Similarly, a study done among people in western Uganda showed that occupation status was associated with COVID 19 vaccination. However, the findings in that study showed that students and civil servants were more likely to accept the COVID-19 vaccine than other people. [33] Whereas in this current study, peasants were more likely to receive the COVID-19 vaccine than others.

At bivariate analysis, being a catholic was found to be associated with COVID-19 vaccination with COR=0.411, CI=0.200-0.846, P-0.016. The study also revealed that Catholics were 0.411 times more likely to get vaccinated against COVID-19 than other religions. Religion has also been cited as one of the key factors to consider during vaccinations across the globe. [41]. Although this study found out that Catholics were more likely to be vaccinated than other religions, also, one study found out that Muslims and pagans were less likely than other religious denominations to receive the COVID-19 vaccine and this showed that religion is a factor influencing vaccination. [20]. Other studies such as one done in Nigeria revealed that religious leaders had a wrong perception of some vaccines. [42]. Similarly, Kanyike found that religion was associated with willingness to receive the COVID-19 vaccine. [38].

Results from individual factors also showed that utilization of health facilities for health care was associated with COVID 19 vaccination

(COR=0.047, CI=0.014-0.162, P=0.000) and sometimes the utilization of health facilities for health care (COR=0.001, CI=0.000-0.004, p=0.000). This means that those who accessed healthcare services from health facilities and sometimes, were more likely to get vaccinated against COVID-19 than those who utilized traditional herbs. Those who utilized healthcare facilities were more likely to get vaccinated against COVID-19. This shows their attitude towards health care, which is an indicator of acceptance towards COVID-19 vaccination.

This study also revealed that having a negative attitude towards COVID 19 vaccination influenced the vaccination status of the people. Results from bivariate and multivariate logistic regression revealed the following results: COR=312, CI=71.466-1362.09, P=0.000 & AOR=42.637, CI=320.65, P=0.000. Results showed that people with negative attitudes towards COVID 19 vaccination were 42.637 times less likely to get vaccinated. Attitude helps to measure the degree of acceptance of COVID-19 vaccination. In this study, it can be seen that Negative attitudes towards COVID 19 vaccination influence COVID 19 vaccination.

Socio-economic Determinants for COVID-19 Vaccination

The current study revealed that income was associated with COVID 19 vaccination. The study found out that those who earned income less than 101,000 and between 101,000 to 300, 000 were more likely to get vaccinated than those who earned income above 300,000 Uganda shillings. The current study findings disagree with findings in one study which reported a higher level of willingness to receive COVID-19 vaccine among those who earned higher household income than those who earned a low level of income. [43]. However, income remains a predictor of COVID-19 vaccination. This study involved the majority of the people in slums and their earned income is less than 300,000 Uganda shillings. These are people involved in small businesses in the slums such as hawking, making chapatis and offering cheaper services such as cleaning for the community among others.

The results also showed that having no work-related effect/issue was associated with COVID-19 vaccination. This showed that having no work pressure was associated with COVID 19 vaccination. This meant that those without any work-related effects were 0.327 times more likely to get vaccinated against COVID-19 than those with work effects. This also could be because people with no work issues have enough time to go for COVID-19 vaccination than those who are engaged in work activities and are occupied.

The study also revealed that being of low social class was associated with COVID-19 vaccination (COR=11.426, CI=3.475-37.571, P=0.012). This meant that people with low social class in Katanga, Kampala were about 11.426 times more likely to get vaccinated than those of the elite class. Similarly, a study in India showed that social class influenced COVID 19 vaccination. [44]. People of low economic social class in this nature were more likely to be vaccinated because this study first all involved people living in slum areas and of these, the majority were of low social class (69%).

Health Facility Determinants for Willingness for Uptake of COVID-19 Vaccination

The current study revealed that sensitization about COVID 19 vaccination influenced COVID-19 Vaccination. Therefore, this study found out that people who were sensitized about COVID-19 vaccination were 1.889 times more likely to get vaccinated against COVID-19 than those who were not vaccinated. In Uganda of recent according to the Ministry of Health Uganda, there was an aim to vaccinate at least 20 million people 49.6% of the Ugandan population with the COVID Vaccine from [45]. No mass education had been done about the

vaccines and people were fear to take on the vaccine. Therefore, awareness and sensitization of people against COVID-19 influences COVID-19 vaccination.

Similarly, WHO and health experts recommended educational campaigns and encouragement of leaders in different communities including health professionals to boost vaccine uptake. [33, 46]. The people in Uganda lacked a lot of information regarding the COVID-19 vaccine and some were misinformed by information on social media which created a lot of mistrust and much suspicion about the COVID-19 vaccine. [47].

The current study also revealed that waiting time at the health facility for services influences COVID 19 vaccination. Those who waited at the Facility for fewer hours were more likely to get vaccinated than those who waited for longer hours. Long waiting hours during service delivery act as push factors against accessibility to health services. Similarly, a study done at Columbia University showed that long client waiting times to receive COVID 19 vaccine led to a decline in COVID 19 vaccination rate in health facilities [48].

The study also revealed that the availability of health workers at the health facility influences COVID 19 vaccination. This study revealed that the availability of health workers at the health facility was 0.211 times more likely to increase COVID-19 vaccination rates at the facility. The presence of health workers at the facility plays a key role in service delivery in the community. Uganda has suffered many cases of strikes from health workers due to low payments and delayed payments of allowances. All these have led to ignorance among health workers in the delivery of services to public health facilities. Therefore, if health workers are available at their workplaces to deliver COVID-19 vaccination services, this means that more people will turn up for vaccination.

The current study also revealed that good attitudes of health workers influenced COVID 19 vaccination. This means that the presence of health workers with good attitudes expressed to clients was associated with increased COVID-19 vaccinations of about 79.97 times. Several studies have been conducted in the US and have found that the factors affecting vaccination completion and these findings were attitudes of health workers towards patients/clients as one of the factors influencing Vaccination. [49].

Availability of COVID 19 vaccines at the health facility was also found to influence COVID 19 vaccination among residents of Katanga, Kampala, Uganda (AOR=0.054, CI=0.006-0.514, P=0.011). This means that availability of COVID-19 vaccines increases COVID-19 vaccination among people by 0.054 times. In bivariate analysis, results showed that lack of essential items for use during vaccination influenced COVID-19 vaccination among people (COR=0.002, CI=0.000-0.006, P=0.000). This means that the lack of essentials for COVID-19 vaccination is more likely to reduce COVID-19 vaccination by about 0.002 times. Similarly, a study reported that the absence of hand washing facilities such as soap increased the risk of spreading COVID-19 [50]. Soap molecules disrupt SARS-CoV-2's outer lipid membrane, killing the microbe; running water then flushes away the viral fragments. [51]. Therefore, the absence of soap and masks influences the prevention and management of COVID-19 among health workers.

Similarly, another study found another factor associated with COVID-19 vaccination; availability of the vaccines. Reports from Uganda have shown that if vaccines are in stock, more people will receive the vaccine as compared to when the COVID-19 vaccines are out of stock (Samuel, 2021). The inadequate stock of vaccines has been a key factor influencing the willingness of people to receive the COVID-19 vaccine in developing countries and Africa. [52].

The results also showed that having no additional cost incurred on COVID-19 vaccination among people was associated with

COVID-19 vaccination (COR=0.018, CI=0.004-0.087, P=0.000). Having no additional cost to incur in COVID-19 vaccination at the facility increased COVID-19 vaccination by about 0.018 times. Cost is a key determinant of client-seeking behaviour. In Uganda, COVID 19 vaccination was offered freely in public health facilities and this could be the reason why people in Katanga had to access free COVID 19 vaccination services. Katanga is also Located near the National Referral Hospital-Mulago which makes it easier for them to access vaccination services.

Other similar studies have also found that Cost influences Vaccination. A study in Uganda found the reason for some students not being vaccinated was because of the high costs of vaccination in some health facilities in Cameroon. In Uganda, MoH emphasizes free vaccination but it's not known as to why in some health facilities, the vaccination is paid for. For example, at Norvik Hospital Kampala, the vaccine was paid for by clients. One study recommended giving the vaccine at no cost would increase the uptake among people because sometimes the costs charged are high [53]. This finding is coherent with the current study findings where free COVID 19 vaccination services would increase COVID 19 vaccination rate.

The local leaders also sighted challenges encountered in the process of mobilization as a significant number of people with negative attitudes towards willingness for uptake of COVID-19 vaccination as well as some politicians who defied the SOPs like social distancing during political campaigns. Other challenges include the lack of adequate facilities like megaphones, as well as the facilitation of the VHTs we work with. The local leader however commended the country's health system for introducing community outreaches without which only 50% of the fully vaccinated people would have subscribed to uptake at the health facility by the time of the study.

Implication for Clinical Practice

The study on determinants of COVID-19 vaccination in Uganda, particularly focusing on slum dwellers in Katanga, Kampala, holds significant implications for public health policy and intervention strategies. Understanding the factors influencing vaccination uptake among this vulnerable population is crucial for ensuring equitable access to immunization services and achieving widespread coverage to curb the spread of the virus. By identifying barriers such as socioeconomic disparities, access to healthcare services, awareness levels, and trust in vaccination programs, policymakers can tailor interventions to address these specific challenges. Targeted communication campaigns, community engagement initiatives, and improved accessibility of vaccination sites in slum areas could enhance vaccine acceptance and uptake. Additionally, addressing underlying socioeconomic factors and strengthening health systems in marginalized communities are essential for promoting vaccine equity and effectively controlling the COVID-19 pandemic in Uganda.

Implication for Future Research

The study on determinants of COVID-19 vaccination among slum dwellers in Katanga, Kampala, Uganda presents several implications for future research endeavours. Firstly, further investigations could delve deeper into specific barriers identified in this study, such as socioeconomic disparities and access to healthcare services, to uncover nuanced factors that may influence vaccine uptake among marginalized populations. Additionally, longitudinal studies could assess the long-term impact of interventions aimed at addressing these determinants on vaccination rates and health outcomes. Moreover, comparative studies across different slum communities or regions within Uganda could provide insights into variations in vaccine uptake and the effectiveness of intervention strategies, thereby

informing targeted approaches for specific contexts. Furthermore, qualitative research exploring the cultural and social factors shaping attitudes towards vaccination among slum dwellers could complement quantitative findings and offer a comprehensive understanding of vaccine hesitancy and acceptance in these communities. Overall, future research endeavours should strive to generate evidence-based recommendations to inform policy development and improve vaccination coverage among vulnerable populations in Uganda and beyond.

A country-wide study needs to be done to involve all the districts in Uganda and all regions of the country so as to determine the actual uptake of the COVID-19 vaccine, the factors influencing its uptake and its improvement of Health-Related Quality of Life. This needs to be done since the current study was done only in Katanga slum, Kampala, central Uganda.

Limitation

Bad weather like rains and thunderstorms were expected to interrupt the program, while some respondents were expected to either require a lot of explanation before they consent to the study or even drop out amid the study, wasting a lot of time or post-COVID 19 lockdown effects, where people were languishing in abject poverty and may have not recovered from the era, hence not willing to respond.

Recommendation

The Ugandan government and the Ministry of Health needed to create more awareness among the public to ensure that the public has enough information on the benefits of COVID-19 19 this would also help reduce the myths that existed in society regarding the side effects of the COVID-19 vaccine.

There is a need for the Ministry of Health Uganda to strategize ways of improving the level of vaccine ordering and storage in health facilities. This may not only target the COVID-19 vaccine, but Uganda as a Whole has been a victim of a lack of enough vaccines to meet the demand of the population. With also high levels of corruption, some of these vaccines end up in Private health facilities creating a big gap in the public sector.

Conclusion

The study concludes that the demographic determinants of covid 19 vaccination are; age (26-35 years), sex; being male, education level; primary level, marital status, being a peasant, religion; catholic, utilization of health care facilities, and attitudes towards COVID 19 vaccination. The study findings found that more than half of the demographic characteristics had a significant impact on COVID-19 vaccination. The study revealed that income, work effect, and social class as the socio-economic determinants of COVID-19 vaccination among Katanga residents, in Kampala, Uganda. This study also revealed that sensitization of the public, awareness, waiting time at the facility, availability of health workers, attitudes of health workers, availability of vaccines and essentials utilized in COVID 19 vaccination, provision of free COVID 19 vaccination with no other costs attached were the health facility related determinants of COVID 19 vaccination among Katanga Residents.

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The self-funded nature of this research emphasizes the intrinsic value and dedication to advancing public health understanding and addressing pressing issues even in resource-constrained settings.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this research.

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