Awareness and Acceptance of COVID-19 Vaccines among Pharmacy Students in Zambia: The Implications for Addressing Vaccine Hesitancy

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Abstract

Background: Several vaccines have been developed and administered since coronavirus disease 2019 (COVID-19) was declared a pandemic in March 2020. In April 2021, the authorities in Zambia administered the first doses of the Oxford-AstraZeneca® COVID-19 vaccine. However, little is known about the awareness and acceptability of the vaccines among the Zambian population. This study was undertaken to address this starting with undergraduate pharmacy students in Zambia.

Materials and methods: A descriptive cross-sectional survey was conducted among 326 undergraduate pharmacy students in Zambia using an online semi-structured questionnaire from 12th to 25th April 2021 and analysed using Stata version 16. Test of associations were undertaken using Pearson chi-square test or Fisher's exact test as appropriate. The multivariable logistic regression was used to investigate the determinants of awareness and acceptability. All statistical tests were performed at a 5% significance level and 95% confidence level.

Results: Among 326 participants, 98.8% were aware of the COVID-19 vaccination programme but only 24.5% would accept the vaccine should it be made available to them. Awareness of the COVID-19 vaccine was influenced by religious beliefs (aOR=0.01, 95% CI: 0.01 to 0.20, p=0.004). Being male (aOR=1.78, 95% CI: 1.05 to 3.02, p=0.034) and single (aOR=2.61, 95% CI: 1.04 to 6.55, p=0.041) was associated with higher odds of accepting the vaccine. Being unemployed (aOR=0.31, 95% CI: 0.15 to 0.66, p=0.002) was associated with lower odds of vaccine acceptancy. Barriers to acceptance of the vaccine were possible side effects (78.5%) and scepticism about its effectiveness to prevent COVID-19 (10.2%).

Conclusion: There was significant vaccine hesitancy towards COVID-19 vaccines among Zambian pharmacy students despite their awareness about the vaccines. Health authorities must work collaboratively with the Universities and other institutions to mitigate vaccine hesitancy, especially with pharmacy students a key part of the future healthcare workforce overseeing disease prevention strategies. These findings can help guide future interventions to address vaccine hesitancy to reduce future transmission rates of this virus.

Background

The novel coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in late 2019 in Wuhan City, China (1, 2). Subsequently declared a pandemic by the World Health Organization (WHO) on 11 March 2020 (3-5) and spread rapidly across the globe bringing appreciable socioeconomic disruption alongside increased morbidity and mortality (6-11).

Despite the initial containment of the pandemic in several countries including African and Asian countries through lockdowns and other measures including social distancing, the mandatory wearing of personal protective equipment (PPE), promoting regular hand hygiene, closure of borders and mass testing (12-18), infection rates continue to increase (19). Alongside this, we have seen the rise in morbidity and mortality from other diseases, including non-communicable diseases (NCDs) as a result of lockdown and other measures (20-23). Alongside this, Abbas *et al.* (2020) recently calculated that across Africa for every one excess death due to COVID-19, continuing with routine vaccination as opposed to lockdown measures could have prevented 84 deaths in children due to infectious diseases including diphtheria, hepatitis B, *Haemophilus influenzae* type b, measles, meningitis, *Streptococcus pneumoniae*, rotavirus, tetanus, and yellow fever (24). We are also aware that there has been an appreciable increase in the prescribing and dispensing of antibiotics for patients with COVID-19 despite only a limited number of patients having underlying bacterial infections driving up antimicrobial resistance (AMR) rates (25-28). However, this is not universal with limited increases in the self-purchasing of antibiotics to treat COVID 19 among African and Asian countries with trained pharmacists available as well as legislation being followed (13, 16, 29).

These concerns with the unintended consequences of COVID-19, coupled with the socioeconomic consequences of COVID-19 along with growing morbidity and mortality rates, has resulted in pharmaceutical companies, governments, funding agencies worldwide investing considerable efforts and resources in accelerated research and development of vaccines as a viable future prevention measure once the gene sequence became known (30-34). As of 16 June 2021, there were 287 vaccine candidates, 185 in the pre-clinical phase and 102 in the clinical phase (35). In addition, 22 candidates had been submitted to the WHO for emergency use validation of which 7 had been approved to date (36). This built on 291 candidates available as of January 26 2021 in the tracker organised by the London School of Hygiene and Tropical Medicine (37). However, whilst appreciable progress has been made with vaccination programmes especially among high-income countries, there are still significant challenges. A key challenge is the uncertainty about the acceptance of COVID-19 vaccination among healthcare workers and the public across countries (38-43), with vaccine hesitancy fuelled by certain social media activities (44-46). For any immunization program to be successful, acceptance of the vaccine is critical and mirrors the general awareness of disease risk, vaccine attitudes and demand for vaccination within the general population (25, 47-49).

We have seen vaccine hesitancy, defined as 'delay in acceptance or refusal of vaccination despite the availability of vaccination services in other situations across countries (50-63). Similar variable hesitancy rates have been reported regarding the acceptance of the COVID-19 vaccine (46, 63-66). In his systematic review, Sallam (2021) found low acceptance rates in Kuwait (23.6%) and Jordan (28.4%) versus appreciably higher acceptance rates in China (91.3%), Indonesia (93.3%) and Malaysia (94.3%) (66). Lazarus et al (2021) in their global survey also found variable acceptance rates (65). Other authors also

found low acceptance rates in Egypt (21%) (67), the Democratic Republic of Congo (27.7%) (38), Uganda (37.3%) (68)and Jordan (37.4%) (69). This is likely linked to considerable misinformation regarding the vaccine including data on its effectiveness and safety fuelled, as mentioned, via social media and other activities including conspiracy theories (41, 42, 44, 45). In addition, issues of importance for the vaccine (62). This is similar to the misinformation that has existed for potential treatments for COVID-19 including hydroxychloroquine and the subsequent impact on morbidity, mortality and costs (13, 14, 70-73).

Whilst to date, the morbidity and mortality from COVID-19 appears lower among African countries compared with higher-income countries (12), in Zambia, as of 22 June 2021, there have been 133,659 confirmed cases of COVID-19 with 1,744 deaths and 148,304 vaccine doses have been administered (74). It is hoped that the nationwide programme will accelerate with the recent approval of five vaccines in Zambia building on the WHO's Emergency Use listing of the vaccines (75). Given the concerns with hesitancy surrounding the COVID-19 vaccine across countries (66), we believe there is an urgent need to describe and understand vaccine acceptance levels among the population in Zambia. Subsequently, use the findings to instigate activities to address this building on experiences across countries (44, 50, 66).

Since healthcare workers (HCWs) across countries are heavily involved in the vaccination programme and have typically been prioritized initially for the COVID-19 vaccine, we believed it was necessary to ascertain vaccine awareness and acceptance in this priority group. We started by assessing vaccine awareness and acceptance among pharmacists as they play a key role in any pandemic offering advice to patients regarding ways to reduce transmission and potential treatments as well as increasingly administrating vaccines (16, 76-79). This started with undergraduate pharmacy students as they are the future pharmacists and custodians of medicines and vaccine development. We also aimed to identify barriers that may influence vaccine acceptance and uptake in Zambia in the future. The findings should help develop a working hypothesis for more extensive interventions to improve future vaccination rates in Zambia if concerns were identified.

Materials And Methods

2.1 Study design and target population

We conducted an online cross-sectional study using a self-administered questionnaire to ensure compliance with current public health guidelines such as social distancing and minimal person-to-person interactions. We invited 632 undergraduate pharmacy students enrolled in the pharmacy degree programme from the University of Zambia (UNZA), Lusaka Apex Medical University (LAMU) and Mulungushi University (MU) to participate.

Many students were invited via social media profiles (WhatsApp and Facebook). Consequently, the online questionnaire was made available on Google Forms from 12th to 25th April 2021, during the period when Zambia just started the administration of the Oxford/ AstraZeneca vaccine. Questionnaires were sent to eligible students identified by university registers. To increase participation, reminders were sent twice a week for those who did not respond for three consecutive weeks.

2.2 Sample size calculation

Prior to conducting the study, a representative sample size of the population was calculated using Yamane's formula; n =   (80). A margin of error of 5% and a population of 632 were used. A 10% loss or non-response was anticipated. This resulted in a minimum of 259 study participants.

2.3 Data Collection Tool

A validated questionnaire was adapted from recent studies regarding COVID-19 vaccine acceptability across countries (38, 67, 81). The questionnaire was first circulated to experts from the University of Zambia and Copperbelt University to allow for content and face validation. The modified questionnaire was subsequently pre-tested on 20 pharmacy students at UNZA, who, later were excluded from the main study. We added questions on awareness and removed the questions on attitude and perceptions as our study did not focus on these two aspects.

The adapted questionnaire (Appendix) was used to collect data on socio-demographic characteristics (Section A), awareness (Section B) and acceptability (Section C) of COVID-19 vaccines among pharmacy students in Zambia. Section B contained questions on awareness of the COVID-19 vaccine. Students who scored 50% and above were grouped as being aware of the COVID-19 vaccines. Section C contained questions on the acceptability of vaccination against the COVID-19 vaccine.

2.4 Study variables

The study had two objectives. The first objective was to assess the awareness of COVID-19 among the pharmacy students. The second objective was to determine the acceptability of the COVID-19 vaccine among pharmacy students if made available on the Zambian market.

For the first objective, we measured awareness scores as a binary variable (1=aware if scored 50 or more, 0=not aware if scored less than 50), and for the second objective, we measured vaccine acceptance (1=yes, 0=no) based on average scores.

Students who scored 50% and above were grouped as willing to be vaccinated against COVID-19. For the two objectives, we collected the following determinants: religion measured as Christian, Islam and others, i.e., minor religions in Zambia such as Hinduism and Buddhism, and employment status as pharmacy students in Zambia, i.e., comprising those in employment as pharmacy technologists (holders of a diploma) and those that come directly into the degree programmes from high school. In addition, gender, residential area (rural-urban, rural and urban), heard of the COVID-19 vaccine (yes/no), source of information (Friends/Family, Health workers, Internet, Radio and Television) and age (number of years from the date of last birthday).

Since our study outcomes included ascertaining awareness and acceptability of the COVID-19 vaccine, we also assessed undergraduate students' awareness and acceptability of vaccination against COVID-19.

2.5 Data Analysis

Stata/IC version 16 (Stata Corp., College Station, Texas, USA) was used for statistical analysis. Descriptive analysis was done on the socio-demographic characteristics of participants. Categorical variables were expressed as frequencies and percentages. Association between demographic variables and outcomes of interest were done using the Pearson chi-square test or Fisher's exact test as appropriate.

Bivariate logistic regression was fitted to obtain crude estimates (results not shown) for the two outcomes, awareness (yes=1, no=0) and acceptability (yes=1, no=0). Separate multivariable logistic regression models were fitted for the two outcomes, including only variables with a $p<0.20$ from the bivariate analysis to adjust for confounders. The multivariable regression models were fitted using stepwise regression and backward elimination algorithms with a liberal p-value for exclusion ($p=0.20$). Interactions were investigated, and none was found to approach statistical significance. Hosmer-Lemeshow goodness-of-fit test was used to assess the predictive ability of the model. All statistical tests were done at a 5% significance level and 95% confidence level.

2.6 Ethical approval

The study protocol was approved by the University of Zambia Health Sciences Research Ethics Committee (UNZAHSREC) and the Zambia National Health Research Authority (NHRA). The study was approved under the protocol ID: 20190217024, IORG no: 0009227, IRB no: 00011000. All participants were aware of the objectives of the study and provided informed consent by reading and responding to the online survey.

Results

3.1 General including sociodemographic characteristics

A total of 326 undergaduate pharmacy students out of the invited 632 students completed the questionnaire thereby giving a response rate of 52%. The sociodemographic characteristics of respondents according to awareness and acceptability of COVID-19 vaccination are shown in Table 1.

The internet was the principal source of information for all respondents who were aware of COVID-19 vaccines. Having heard of COVID-19 (p=0.012) and religion status (p=0.048) were significantly associated with awareness scores. Overall, awareness of COVID-19 among participants was 98.77% (n = 322).

Table 1: Sociodemographic characteristics of the participants according to their awareness of COVID-19 vaccination

Characteristic	Category	Total population N (%)	Awareness (<50% score) N (%)	Awareness (≥50% score) N (%)	P-value[a]
Age (years)	18-23	157(48.16)	3 (75.00)	154(47.83)	0.841
	24-29	110 (33.74)	1 (25.00)	109(33.85)	
	30-35	38 (11.66)	0	38(11.80)	
	36-41	16 (4.91)	0	16(4.97)	
	>41	5 (1.53)	0	5(1.55)	
Gender	Female	162 (49.69)	1 (25.00)	161(50.00)	0.623
	Male	164 (50.31)	3 (75.00)	161(50.00)	
Marital status	Married	55(16.87)	0	55(17.08)	1.000
	Single	271(83.13)	4(100)	267(82.92)	
Religion	Christianity	322(98.77)	3(75.00)	319(99.07)	**0.048**
	Islam	2(0.61)	0	2(0.62)	
	Others	2(0.61)	1(25.00)	1(0.31)	
Employment	Yes	86(26.38)	0	86(26.71)	0.292
	No	240(73.62)	4(100)	236(73.29)	
Residential area	Rural-Urban	64(19.63)	1(25.00)	63(19.57)	0.355
	Rural	35(10.74)	1(25.00)	34(10.56)	
	Urban	227(69.63)	2(50.00)	225(69.88)	
Heard of the COVID-19 vaccine	No	1(0.31)	1(25.00)	0	**0.012**
	Yes	325(99.69)	3(75.00)	322(100)	
Source of information	Friends/family	5(1.53)	0	5(1.55)	0.232
	Health	29(8.90)	1(25.00)	28(8.70)	
	workers	159(48.77)	3(75.00)	156(48.45)	
	Internet	4(1.23)	0	4(1.24)	
	Radio	129(39.57)	0	129(40.06)	
	Television				
Overall		**N=326**	**(N=4) 1.23%**	**(N=322) 98.77%**	

Key: [a]= Fisher's exact test

The sociodemographic characteristics of the participants according to their COVID-19 vaccine acceptability are shown in Table 2. There was evidence of an association between acceptability and employment status (p=0.044) and the gender of participants (p=0.024). The overall acceptability of the COVID-19 vaccination among participants was 24.54% (n=80).

Table 2: Sociodemographic characteristics of the participants according to their acceptability of the COVID-19 vaccine

Characteristic	Category	Total population N (%)	Acceptability (<50% score)	Acceptability (≥50% score)	P-value
Age (years)	18-23	157(48.16)	123(50.81)	32(40.00)	0.246[a]
	24-29	110(33.74)	82(33.33)	28(35.00)	
	30-35	38(11.66)	24(9.76)	14(17.50)	
	36-41	16(4.91)	11(4.47)	5(6.25)	
	>41	5(1.53)	4(1.63)	1(1.25)	
Gender	Female	162(49.69)	131(53.25)	31(38.75)	0.024[b]
	Male	164(50.31)	115(46.75)	49(61.25)	
Marital status	Married	55(16.87)	41(16.67)	14(17.50)	**0.092[a]**
	Single	271(83.13)	205(83.33)	66(82.50)	
Religion	Christianity	322(98.77)	244(99.19)	78(97.50)	0.116[a]
	Islam	2(0.61)	2(0.81)	0	
	Others	2(0.61)	0	2(2.50)	
Employment	Yes	86(26.38)	58(23.58)	28(35.00)	0.044[b]
	No	240(73.62)	188(76.42)	52(65.00)	
Residential area	Rural-Urban	64(19.63)	49(19.92)	15(18.75)	0.966[b]
	Rural	35(10.74)	26(10.57)	9(11.25)	
	Urban	227(69.63)	171(69.51)	56(70.00)	
Heard of the COVID-19 vaccine	Yes	325(99.69)	245(99.59)	80(100)	1.000[a]
	No	1(0.31)	1(0.41)	0	
Source of information	Friends/family	5(1.53)	5(2.03)	0	0.412[a]
	Health workers	29(8.90)	20(8.13)	9(11.25)	
	Internet	159(48.77)	125(50.81)	34(42.50)	
	Radio	4(1.23)	3(1.22)	1(1.25)	
	Television	129(39.57)	93(37.80)	36(45.00)	
Overall		N=326	(N=246) 75.46%	(N=80) 24.54%	

Key: [a]= Fisher's exact test, [b]=Pearson Chi-square test

3.2 Factors influencing awareness and acceptability of COVID-19 vaccines

Being of other religion compared to the Christian faith was associated with reduced odds of awareness of the COVID-19 vaccination (aOR=0.01, 95% CI: 0.01 to 0.20, p=0.004) adjusting for gender and residential area (Table 3).

Being unemployed (aOR=0.31, 95% CI: 0.15 to 0.66, p=0.002) was significantly associated with reduced odds of acceptability of COVID-19 vaccination controlling for the sex of the participant. On the other hand, male gender (aOR=1.78, 95% CI: 1.05 to 3.02, p=0.034) and being married (aOR=2.61, 95% CI: 1.04 to 6.55, p=0.041) was independently associated with increased odds of acceptability of COVID-19 vaccination.

Table 3: Adjusted Multivariable logistic regression of factors associated with awareness and acceptability of COVID vaccines

Characteristic	Category	Awareness of COVID-19 (≥50% score)		Acceptability of COVID-19 vaccine (≥50% score)	
		aOR (95% CI)	*P*-value	aOR (95% CI)	*P*-value
Gender	Female	-	-	Ref	0.034
	Male			1.78 (1.05-3.02)	
Marital status	Married			Ref	0.041
	Single			2.61(1.04-6.55)	
Religion	Christianity	Ref			
	Islam	-	0.004		
	Others	0.01(0.01-0.20)			
Employment	Yes			Ref	0.002
	No			0.31(0.15-0.66)	
Residential area	Rural-Urban	Ref			
	Rural	0.54(0.03-8.92)	0.666		
	Urban	3.36(0.20-55.36)	0.397		

Key: aOR-adjusted odds ratios, 95% CI-95% confidence intervals, Students of pharmacy with a diploma are in employment except for direct entrants into the degree program. On category others, we included all minor religions in Zambia (i.e., Hinduism, Buddhism etc). Acceptability was measured as having scores of 50 or more, Awareness was measured as having scores of 50 or more

Reasons for student's refusal to be vaccinated against COVID-19

Out of the 246 participants who were hesitant to receive the COVID-19 vaccine, the majority (78.5%) were concerned about the possible adverse effects of COVID-19 vaccines (Table 4). Similarly, 71.1% felt that the COVID-19 vaccines did not pass through all the stages of clinical trials, hence, their concerns with safety issues.

Table 4: Hesitancy against COVID-19 vaccination among pharmacy students

Reasons for refusing vaccination	Frequency (n)	Percent (%)
I would be hesitant to be vaccinated because		
COVID-19 vaccines are not effective	25	10.2
I am concerned about the safety of COVID-19 vaccines	193	78.5
I do not need the COVID-19 vaccine	28	11.4
Total	246	100
Do you think COVID-19 vaccines have passed through all stages of clinical trials to ensure their safety?		
I don't know	58	23.6
No	175	71.1
Yes	13	5.3
Total	**246**	**100**

Discussion

We believe this is the first study conducted in Zambia to explore the awareness and acceptability of the COVID-19 vaccines among undergraduate pharmacy students.

Encouragingly, we found a high awareness rate of 98.8% for COVID-19 vaccines, similar to medical students in Uganda (98.3%) (68) and the Democratic Republic of Congo (99.3%) (38). This could be attributed to awareness campaigns and information available on news and social media with the students reporting the internet (48.77%), television (39.75% and HCWs (8.90%) as their main sources of information about COVID-19 vaccines. This is different though to the US where the main source of information leading to increased awareness of the COVID-19 vaccine were the health agencies in addition to mass media (82).

However, the low acceptance rate for the COVID-19 vaccine at 24.5% among our pharmacy undergraduates is a concern. This though is similar to low rates of 29.4% among the public in Jordan, Kuwait and Saudi Arabia (42), 34.9% among university students in Jordan (43) and 37.3% among medical students in Uganda (68). This compares with appreciably higher rates of 73% to 77% among medical students in the US (83, 84), 76.3% among college students in China (81), 86.1% among university students in Italy (85), and 91.99% among medical students in Poland (86). Poland's high acceptability may well be because the medical students in the study were fearful of contracting the virus and spreading it to their family and friends (86). We have also seen variable rates of vaccine acceptance among HCWs and others across countries. These range from low acceptance rates of 21% in Egypt (67), 23.4% in Taiwan (87), and 27.7% in the Democratic Republic of Congo (38), similar to the students in our study, up to 55% in Russia (65), 71% in South Africa, 78.1% in Israel (66), 78.5% in Greece (88) and nearly 90% in China (65).

Those who were married and those who were not in employment were less likely to accept the COVID-19 vaccine in our study, while male students were more likely to fearful to accept the vaccine. Other studies have also reported similar gender differences in hesitancy rates for the COVID-19 and other vaccines (38, 65, 66, 89, 90). We are not sure of the reasons behind this difference in our study. This may be due to male participants having a high-risk perception of diseases compared to females, hence a greater willingness to be vaccinated. However, further research is needed before we can make any definitive statements. The higher acceptance rate among employed personnel may be due to their employers recommending vaccination. Other studies have also reported that vaccine acceptability is affected by some factors including sociodemographics (65).

Vaccine safety and effectiveness were the main reasons for vaccine hesitancy among our students, similar to students and HCWs in other countries (64, 67, 68, 91). This includes concerns that the COVID-19 vaccines had not passed through all clinical trial stages to assure safety and effectiveness. The higher rate of vaccine hesitancy seen in our study could also potentially be attributed to adverse reports in social media, conspiracy beliefs and lack of awareness campaigns generally concerning the effectiveness and safety of the different COVID-19 vaccines (44, 68, 83, 86). Interestingly, our recent findings in Zambia are similar to an earlier study in Zambia which documented fear of adverse effects, lack of information on the benefits of vaccines, as well as other beliefs including traditional beliefs as barriers to accessing vaccines (92).

We are aware this study has some limitations. Since the study was limited to pharmacy undergraduate students in Zambia, its results cannot be generalised to students of other healthcare and non-healthcare programmes. Besides, the online nature of the study may have excluded some students because of lack of internet access which may have biased the findings. Despite this, we believe the findings are robust providing direction for the future.

Conclusion

There was a high level of awareness about COVID-19 vaccines among Zambian pharmacy students in this study. In contrast, their acceptability of having the vaccine was low due to some issues including concerns with the safety and efficacy of the COVID-19 vaccines. Consequently, stakeholders in the healthcare sector need to develop strategies to reassure the populace of the safety and efficacy as well as the success story of COVID-19 vaccination. We also believe there is a critical role for the educators in Pharmacy and Medical schools in Zambia and across Africa to reduce the level of misinformation regarding COVID-19 vaccines, similar to general myths surrounding COVID-19 and its treatment. We will be following this up especially given the pivotal role of community pharmacists during any pandemic.

Declarations

Declarations of interest

None

Author contributions

SM conceptualized the study. SM, CNH, MK and WM participated in data collection. SM and MM conducted data analysis. All authors participated in the draft of the initial manuscript. All authors participated in reviewing the intellectual content of the manuscript. All authors approved the final version of the manuscript.

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