

Assessment of Knowledge and Attitude towards Coronavirus Disease 2019 Vaccines among Students in Zambia - A Case Study of the University of Zambia

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Abstract

Equitable access to safe and efficacious vaccines is essential to the fight against Covid-19. Low vaccine acceptance poses a challenge to controlling the Covid-19 pandemic. Young people are key in the fight against Covid-19, as they are a majority in most African populations. A cross-sectional study was used to assess the knowledge and attitude toward Covid-19 vaccines among university students in Zambia. This study comprised a total of 160 respondents with an average age of 21.0 ± 3.6 years, ranging from 18 to 46 years. The study was done between January and February 2022. Random sampling was used for participant enrollment, and an interviewer-administered questionnaire was used for data collection. Spearman's Rank Correlation test and Binary Logistic Regression were performed to establish relationships among the study variables. The study revealed a knowledge score of 61.3%, and a Covid-19 vaccine acceptance score of 28.0%. Knowledge was also found to be associated with Covid-19 vaccine acceptance ($p < 0.05$). Covid-19 vaccine acceptance showed an association with history of having a relative or close friend who had Covid-19 infection ($OR = 2.041$, C.I. 95%, 1.010-4.127; $p < 0.05$), as well as knowledge ($OR = 1.275$, C.I. 95%, 1.045-1.556; $p < 0.05$). The results showed good knowledge of Covid-19 vaccines among students. The attitude was however found to be negative, as indicated by a vaccine acceptance score of 28.0%. Evidence-based health education on the importance of Covid-19 vaccination is needed to counter myths and conspiracy beliefs about the disease to improve vaccine uptake.

Keywords: Vaccines; Covid-19; Acceptance; Attitude; Knowledge; Zambia.

Introduction

Coronavirus Disease 2019 (Covid-19) is caused by a novel Severe Acute Respiratory Syndrome Coronavirus-2 (nSARS-CoV-2) [1]. It is a serious disease with the potential to cause adverse health, social, psychological, and economic effects, making it a grave public health concern globally, and was declared a pandemic on March 11, 2020, by the World Health Organization (WHO) [2]. According to WHO (2022), as of August 24 18, 2022, 595 219 966 cases of Covid-19 were confirmed,

with 6 453 458 deaths recorded worldwide [3]. As a country in the same period, Zambia recorded 332 527 cases of Covid-19 with 4 016 deaths [3].

As a result of the undisputed adverse health and socio-economic effects of Covid-19, many countries put in place social and public health interventions to contain the pandemic's spread. Equitable access to safe and effective vaccines among many public health interventions has been found to be essential for the control of Vaccine-Preventable Diseases (VPDs), Covid-19 included [3].

According to WHO (2022), in 2022, 12 409 086 286 vaccine doses were administered worldwide, with 5 330 599 370 at least having received one dose, and 4 867 565 350 fully vaccinated [3]. As of August 24, 2022, Zambia administered 8 435 595 vaccinations (45.89%) of the population, with 7 540 676 receiving at least one dose and 5 400 440 fully vaccinated [3].

The Africa Centre for Disease Control and Prevention (ACDC), as of August 17, 2022, confirmed 12 035 399 cases of Covid-19 with 255 528 deaths throughout the continent of Africa [4]. Since the outbreak, many countries worldwide have developed and approved the use of several Covid-19 vaccines [5]. With the vaccinations already underway and considering the low vaccination coverage in Africa, it was crucial to assess the population's levels of knowledge and attitude of acceptance/non-acceptance of the Covid-19 vaccines, especially for young people as they make up the majority of the many African countries. Students, who are majorly young people, may not be severely afflicted with Covid-19 infection but could be very efficient carriers and influential spreaders of the disease to high-risk populations such as older people and those with underlining conditions such as diabetes [6].

As of April 14, 2021, Zambia's health authorities approved the use of Covid-19 vaccines under the Covid-19 Vaccines Global Access Facility (Covax) [7]. The National Covid-19 vaccine plans prioritized frontline healthcare workers and those key to maintaining major societal functions comprising teachers, immigration officers, police officers, religious and traditional leaders, as well as those at high risk of developing severe Covid-19 disease, especially individuals with other underlining diseases, the aged (above 65 years), and populations in congregate settings [7].

Despite many studies on the assessment of the knowledge and attitude of young people towards Covid-19 vaccines worldwide, there is

still limited information on this population in Zambia. The study was carried as a public health intervention study with the view to help policymakers and public health program designers with information that will enable them to come up with sound Covid-19 public health intervention. The programs would factor in the perspectives of young people about Covid-19 vaccines to increase their engagement for effective response against the disease [8]. These would also increase vaccine uptake and consequently enhance infection control, not only in higher learning institutions but also in the general population [8].

Methods

Aim

The study was aimed at assessing the knowledge and attitude towards Covid-19 vaccines among students at the University of Zambia - Great East Road Campus (UNZA-GERC), Lusaka, Zambia.

Study Design

A cross-sectional study design was used in the present study. Enrolment of the study participants was done by random sampling. Data was collected using a pre-tested semi-structured interviewer-administered questionnaire. Two students not included in the study were trained and thereafter engaged in helping with data collection through questionnaire administration. After collection, the data were cleaned up for any errors, and later analysed.

Sample Size Determination

The study population included participants meeting the inclusion criteria, and these were students aged 18 years and above enrolled at UNZA-GERC. The exclusion criteria included students not enrolled at UNZA-GERC and outside the required age range.

Using the sample determination equation and the outlined parameters, the sample size for the study was determined as shown below.

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where:

n= Estimated sample size.

z= 1.96 (Estimated sample size from an unknown population size).

p= 0.106 Estimated Zambia's Covid-19 Prevalence [10].

d= 0.05 (corresponding to effect size).

Therefore,

$$n = \frac{z^2 p(1-p)}{d^2}$$

$$n = \frac{(1.96)^2 (0.106)(1 - 0.106)}{(0.05)^2}$$

$$n = 145.6.$$

$$n = 147.$$

Assuming the possibility of having a non-response rate of **10%**, the estimated targeted sample size for the study was **160**.

Study Setting

The study was conducted at the University of Zambia, Great East Road Campus (UNZA-GERC) in Lusaka as in Figure 1 below.

Study Site

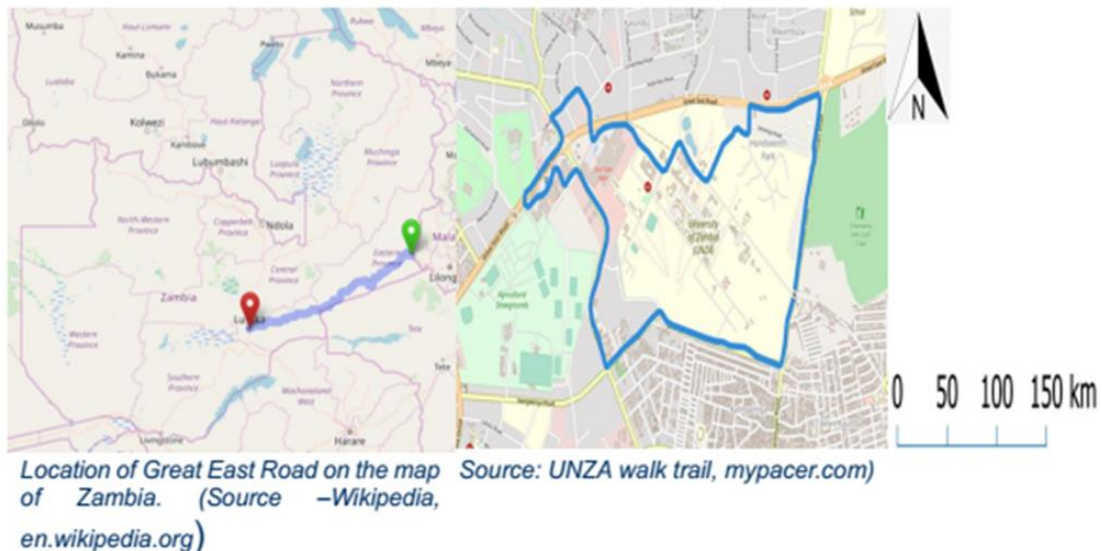


Figure 1. University of Zambia, Great East Road Campus (UNZA-GERC) in Lusaka

The University of Zambia is the largest public institution of higher learning in Zambia and was established by an Act of Parliament No. 66 of 1965 of the laws of Zambia [11]. The University has two campuses, both located in Lusaka. The UNZA-GERC, located along the Great East Road, about 6 km from the city centre, and is the larger of the two campuses. The other campus, Ridgeway Campus, is relatively smaller and houses four out of the 12 faculties of the university [11].

Data Analysis

The statistical analyses were performed using SPSS version 20 (IBM Analytics,

Armonk, NY). A descriptive analysis of the data was performed to obtain participants' socio-demographic characteristics, which included data on Covid-19 infection, and the infection of their relatives or close friends. Knowledge of Covid-19 vaccines of the participants was expressed as a mean score of correct answers out of the total 11 knowledge-based questions in the questionnaire. The non-normal distribution nature of the study population necessitated the use of Spearman's Rank Correlation Order test. A Spearman Rank Order Correlation was used to assess correlations between knowledge and other variables, including vaccine acceptance

(attitude). Binary Logistic Regression was used to determine the relationship between each independent variable found related with vaccine acceptance upon running the Spearman Rank Test. The vaccine acceptance score was used as a dependent variable for the Regression Analysis.

The logistic model's Omnibus test was significant with a p-value = 0.001. The Hosmer – Lemeshow test was used to determine the model's fitness and was insignificant as per the requirement with a p-value = 0.403 [12]. The overall Percentage Accuracy Classification (PAC) was 63.1%. A p-value of less than 0.05

($p < 0.05$) was used to indicate statistical significance in all the statistical tests performed.

Results

Socio-demographic Characteristics of the Study Participants

The study population consisted mostly of male students comprising 56.3% of the total population and 43.7% of females. The median age of the study participants was 20 years. In the current study, the participants reported ever being infected with Covid-19 was 17.5%. However, about 63.0% of them reported of having either a relative or close friend infected with Covid-19, as shown in Table 1.

Table 1. Participant's Socio-demographic Characteristics

Variable	Participants
	<i>n</i> = 160
Gender, <i>n</i> (%)	
Male	90 (56.3)
Female	70 (43.7)
Age, years	
Mean $\pm$ SD	21.0 $\pm$ 3.6
Median	20
Interquartile Range	19 – 22
Range	18 – 46
Covid-19 Infection, <i>n</i> (%)	
Yes	28 (17.5)
Asymptomatic	5 (3.1)
Symptomatic	10 (6.3)
Severe	0 (0)
No	125 (78.1)
Covid-19 infection in relative/close friend, <i>n</i> (%)	
Yes	100 (62.5)
Asymptomatic	5 (3.1)
Symptomatic	15 (9.4)
Severe	8 (5.0)
No	53 (33.1)

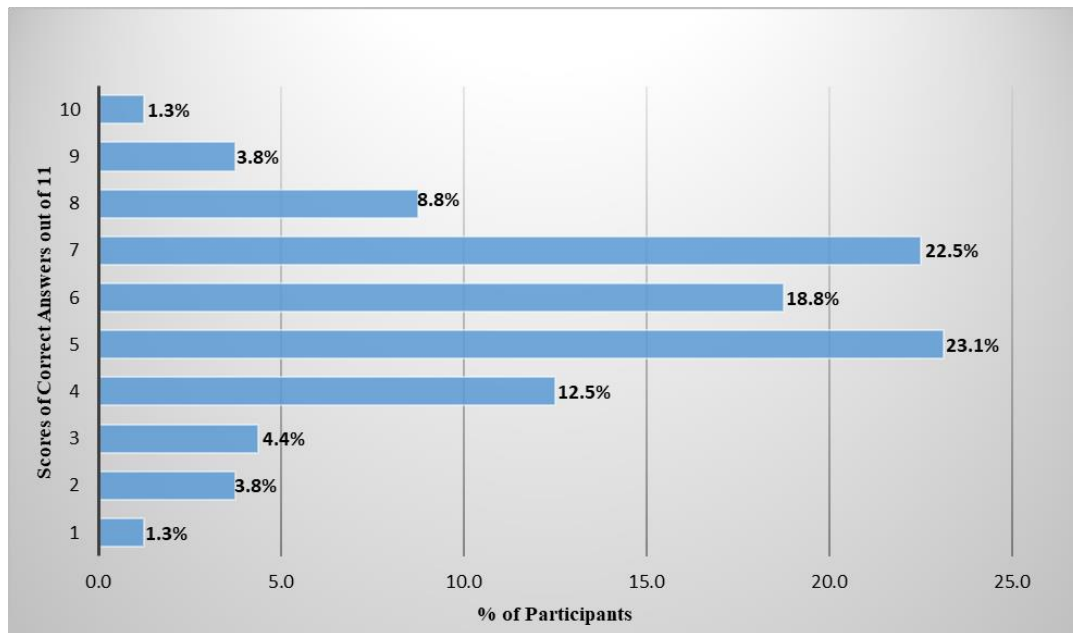


Figure 2. Covid-19 Vaccines Participant's Knowledge Level Scores

Knowledge and Sources of Information on Covid-19 vaccination

The knowledge level scores about Covid-19 vaccines are shown in Figure 2. The majority (23%) of the study participants scored 5 out of 11 on the knowledge-based questions. The median vaccine knowledge score was approximately 7. The minimum score was 1 out of 11, and the maximum was 10 out of 11, comprising 1.3% of the study participants for both scores. The current study further showed varying opinions regarding Covid-19 vaccines and vaccinations, as shown in Table 2. About 82.5% of the population expressed knowledge of the existence of Johnson & Johnson's

Janssen vaccine among the many other vaccines available in Zambia and about 64.0% of the participants agreed that Covid-19 vaccines could reduce symptoms of Covid-19. 80.6% of the study participants were of the opinion that Covid-19 vaccination should not be mandatory. On the sources of information about Covid-19 vaccination, the study showed that the study participants' primary source of information was mass media which included television and radio, consisting of 80.6%, followed by 68.1% social media, and the least source of information (33.1%) being peer-reviewed journals.

Table 2. Participant's Knowledge and Sources of Information about Covid-19 Vaccination

Question		Respondents (n=160)
What are some of the currently available Covid-19 Vaccines in Zambia? n (%)		
Sinopharm		40 (25.0)
Astra Zeneca		96 (60.0)
Johnson & Johnson's Janssen		132 (82.5)
What is the maximum recommended number of dose/s for each of the available Covid-19 vaccines? n (%)		
Sinopharm	1 dose	16 (10.0)
	2 doses	39 (24.4)
Astra Zeneca	1 dose	17 (10.6)

	2 doses	76 (47.5)
Johnson & Johnson's Janssen	1 dose	76 (47.5)
	2 doses	34 (21.3)
Are Covid-19 vaccines effective at preventing Covid-19 infection? <i>n</i> (%)		
Yes		79 (49.4)
No		79 (49.4)
Do Covid-19 vaccines reduce symptoms of Covid-19? <i>n</i> (%)		
Yes		103 (64.4)
No		54 (33.8)
Do Covid-19 vaccines cause the disease in order to trigger immunity? <i>n</i> (%)		
Yes		84 (52.5)
No		67 (41.9)
Cont. Participant's Knowledge and Sources of Information about Covid-19 Vaccination		
Do Covid-19 vaccines change the DNA of those vaccinated? <i>n</i> (%)		
Yes		36 (22.5)
No		122 (76.3)
Can people vaccinated against Covid-19 avoid other prevention measures such as handwashing, hand sanitizers, and face masks? <i>n</i> (%)		
Yes		26 (16.3)
No		132 (82.5)
Do all Zambians need to be vaccinated against Covid-19? <i>n</i> (%)		
Yes		73 (45.6)
No		81 (50.6)
Is it only health personnel and the elderly who need to be vaccinated against Covid-19? <i>n</i> (%)		
Yes		25 (15.6)
No		133 (83.1)
Can Covid-19 vaccines cause health problems? <i>n</i> (%)		
Yes		94 (58.8)
No		62 (38.8)
Should Covid-19 vaccination be mandatory? <i>n</i> (%)		
Yes		29 (18.1)
No		129 (80.6)
What are your primary sources of information about Covid-19 vaccination? <i>n</i> (%)		
Health care personnel		88 (55.0)
Scientists (published articles in specialized scientific journals)		53 (33.1)
Mass media such as Television and Radio		129 (80.6)
Social media, e.g., WhatsApp, Facebook, and Twitter		109 (68.1)
YouTube		70 (43.8)

Attitude towards Covid-19 Vaccination

The statistics of the study participant's attitudes towards Covid-19 vaccination and vaccines, in general, are shown in Table 3. Equally, the factors for one's motivations to be vaccinated or not are shown in the same table.

The study results showed that about 31% of the study participants were vaccinated against Covid-19, whereas 32% of study participants expressed willingness to be vaccinated against Covid-19. However, about 33% were unwilling to be vaccinated, and about 29% were

undecided. The study participants with a negative attitude towards Covid-19 vaccines and probably unvaccinated doubted the

effectiveness of the Covid-19 vaccines as were of the opinion that the Covid-19 vaccines were hurriedly developed.

Table 3. Participant's Attitude towards Covid-19 Vaccination

Question, <i>n</i> (%)	Respondents
	<i>n</i> = 160
1. Are you favorable to vaccination? <i>n</i> (%)	
Yes	79 (49.4)
No	79 (49.4)
I do not know	53 (33.1)
2. Are you vaccinated against Covid-19? <i>n</i> (%)	
Yes	49 (30.6)
No	108 (67.5)
3. Have you received at least a single dose of Sinopharm or Astra Zeneca Covid-19? <i>n</i> (%)	
Yes	26 (16.3)
No	131 (81.9)
4. Are you willing to be vaccinated against Covid-19? <i>n</i> (%)	
Yes	51 (31.9)
I don't know	46 (28.8)
No	52 (32.5)
5. What are your motivations for being unwilling to be vaccinated? <i>n</i> (%)	
I do not trust Covid-19 vaccines	26 (16.3)
The Covid-19 vaccines are not effective	132 (82.5)
The Covid-19 vaccines were hurriedly developed	57 (35.6)
I have had Covid-19	13 (8.1)
I am not at risk	30 (18.8)

Correlations of Knowledge and Vaccine Acceptance with other Variables

A significant and positive correlation ($r=0.215$, $p<0.05$) between knowledge and vaccine acceptance was observed in the present study. The regression model built with the

exclusion of all variables not significantly correlated with vaccine acceptance showed a significant positive relationship between vaccine acceptance and both Covid-19 infection in relative/close friends, and knowledge about vaccines, as shown in Table 4.

Table 4. Analysis of Relationships of Knowledge and Attitude with Other Variables

Variable	Knowledge	Attitude (Vaccine Acceptance)
	Spearman's Correlation Coefficient	OR (95% C.I.)
	<i>p</i> -Value	<i>p</i> -Value
Age	0.015	-
	0.853	-
Gender	0.042	-
	0.600	-
Covid-19 infection	0.130	2.006 (0.768 - 5.240)

	0.101	0.155
Covid-19 infection in relative/close friend	0.091	2.041 (1.010 - 4.127) *
	0.250	0.047
Knowledge	1.000	1.275 (1.045 - 1.556) *
	-	0.017
Attitude (Vaccine Acceptance)	0.215**	1.000
	0.006	-

** . Correlation significant at 0.01 level and * . Correlation significant at 0.05 level

Discussion

Low vaccine acceptance in many African countries, Zambia inclusive, poses a significant problem in the fight against Covid-19 [13]. The present study assessed the knowledge and attitude towards Covid-19 vaccines among students to generate critical information concerning the knowledge levels, attitudes, and opinions about Covid-19 vaccines to foster positive behavioral and attitude change towards Covid-19 vaccination.

This study shows a slightly above-average knowledge level of 61.3% ($6.74 + 1.76$) out of 11 total knowledge level-based questions on the study population of students with an average age group of $21.0 + 3.6$ years.

This study also shows that 58.0% of participants reported having scored lower than the median knowledge level within the 25 years and younger age group. The highest proportion of the study population distribution of knowledge level by age group contributed to the not-so-impressive overall knowledge level of the entire study population. This result could be influenced by the unreliable sources of information utilized by young people, which include social media [13]. These sources of information may mainly be engaged in propagating scientifically unverified information about Covid-19 instead of other sources, such as published articles in specialized scientific journals [13]. The result is supported by the findings on sources of information and the negative influence of conspiracy theories on the effective

dissemination of credible and sound scientific information on Covid-19 vaccines and other vaccines in general, as reported by Sallam et al. (2021) [13].

A higher positive attitude towards Covid-19 vaccines was shown in the female gender. The result contrasts with the one reported by Sallam et al. (2021), where a higher vaccine acceptance rate was recorded among the male gender [13]. This case for UNZA could be because of the disproportionate male/female distribution within the study population.

The knowledge level score for this study is slightly higher than the 56.6% reported by Islam et al. (2021) in a study done on a population with the majority aged 23.17 ± 6.05 participants, the age group like this study [14]. However, vaccine knowledge for the study is still low as compared to the other parts of the globe, as evidenced by the study done in Central and Southern Italy, where knowledge levels of 80.0% among university students were recorded [15]. The lack of a score below the median vaccine knowledge level in the 41 years and older age group somehow agrees with the results of a study done by Galle` et al. (2021) that showed greater knowledge in old age [15]. However, this result could be influenced by the narrow range of the distribution of participants by age, especially at the higher extreme of the study population suggesting the influence of the few individuals in the said age group.

Regarding gender, a lower level of vaccine knowledge was reported in the female gender, showing an agreement with the study by Galle et al. (2021) that showed greater knowledge

among male students [15]. This could be due to the higher male/female ratio in the present study (56.3% male and 43.7% female).

The average attitude measure assessed by vaccine acceptance determined by the number of 'yes' responses indicated by the respondents out of the 4 attitude or vaccine acceptance-based questions was 28.0% (1.12 ± 1.34). Spearman's Rank Correlation analysis showed a significant positive correlation between knowledge and vaccine acceptance. This result agrees with the study done by Galle` et al. (2021), where high vaccine acceptance was related to greater knowledge about Covid-19 vaccines [15]. However, no significant relationship was observed between knowledge and other variables, including age, gender, Covid-19 infection, and Covid-19 infection in a relative or close friend. This result disagrees with Galle` et al. (2021), whose study showed a significant correlation between age, gender, and direct or indirect exposure to the disease [15]. This difference in the result could be due to the narrow age range for the present study population, as well as the differences in the socio-demographic characteristics of participants between this study and the Galle et al. (2021) study. The Binary Logistic Regression model with an outcome or dependent variable, Vaccine Acceptance, showed that knowledge and Covid-19 infection in a relative or close friend was related to a positive attitude or high likelihood of accepting Covid-19 vaccination. Other studies also show that high knowledge about Covid-19 vaccines or vaccines, in general, is related to high vaccine acceptance, hence the need to educate the target population about Covid-19 vaccination and its benefits for improved vaccine uptake [15]. The relationship between vaccine acceptance and exposure to the disease through Covid-19 infection of a relative or close friend could be due to the motivation to take the Covid-19 vaccination as a way of protecting oneself against the disease in order not to go through what the relative or friend

went through [15]. Covid-19 infection in the participant was shown not to be related to vaccine acceptance. This observation could result from respondents who had direct experience of the disease through infection, considering themselves of having immunity against new infections, and never saw the need to go for Covid-19 vaccination.

The attitude result for this study is, however, in contrast with the extremely high vaccine acceptance rates of 97.0% in Ecuador, 94.3% in Malaysia, 93.3% in Indonesia, and 93.3% in China reported by Sallam, M. (2021), in a worldwide systematic review on the Covid-19 vaccine hesitancy [16]. This study's recorded vaccine acceptance rate of 28.0% agrees with the lowest vaccine acceptance rates reported by Sallam, M. (2021) of 28.4% in Jordan, 23.6% in Kuwait, and 27.7% in the Democratic Republic of the Congo among healthcare workers [16]. The study done by Bai et al. (2021) indicates that concerns about vaccine safety and efficacy could reduce vaccine uptake [17]. A greater positive attitude was shown in old age, as evidenced by the lack of record of below-median vaccine acceptance scores in the 41 years and older age group. This finding agrees with the study done by Abebe et al. (2021), where a more positive attitude was reported in old age, attributed to the high prevalence of underlining chronic conditions in old age and good knowledge about Covid-19, which act as motivation for greater Covid-19 vaccine acceptance among the aged as compared to the younger populations [18]. Abebe et al. (2021) further suggested that opinions, behavior, and attitude critically affect the rate of vaccine acceptance [18].

Conclusions

The study found high vaccine knowledge and negative attitude towards Covid-19 vaccination among university students in Zambia. The negative attitude towards Covid-19 vaccination could be suggestive of some inefficiencies in the awareness programs

needed to spread credible, evidence-based information on Covid-19 vaccination. Myths and conspiracies about Covid-19 vaccination may undoubtedly remain a challenge in many resource-limited countries. Emphasis on increasing public health intervention programs at increasing awareness of the importance of Covid-19 vaccines in controlling community infections should be recommended. Students should be encouraged to rely on credible sources of information on Covid-19 vaccination, which include healthcare personnel, scientists, and specialized scientific journals. Further studies aiming at establishing robust, cost-effective information and education dissemination strategies integrated with Covid-19 immunization campaigns should be encouraged.

Declarations

Ethics Approval and Consent to Participate

All methods of this study followed the basic guidelines and regulations of ERES converge Institutional Review Boards (IRB) Ethics Committee and the Zambian National Health Research Authority. Informed consent of participants was obtained before data collection.

Authors' Contributions

RH, LS, and TL conceived the idea, designed the study, and analyzed data. RH collected and further analyzed data as well as

compiled the first draft of the manuscript. RH, LS and TL revised the first draft. RH, LS, and TL revised the successive drafts of the manuscript and agreed on the final draft for submission to the journal.

Consent for Publication

Not applicable.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article.

Competing Interests

The authors declare that they have no competing interests.

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