

COVID 19 Vaccination implementation among preparatory school students in Akaki Kality Sub city, Addis Ababa, Ethiopia

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World Journal of Biology Pharmacy and Health Sciences, 2024, 18(01), 257-270

Publication history: Received on 05 March 2024; revised on 13 April 2024; accepted on 16 April 2024

Article DOI: <https://doi.org/10.30574/wjbphs.2024.18.1.0203>

Abstract

Coronavirus (COVID-19) is a global pandemic that has affected 229 countries and territories. Vaccines are one of the best ways to prevent and slow down transmission of COVID 19. Since students in school setting share teaching rooms, sport facilities, and other facilities like toilet and cafeteria, and have a higher number of social contacts, this study aimed to assess implementation of Vaccination against COVID 19 among preparatory school selected secondary preparatory schools in Akaki Kality Sub city, Addis Ababa, Ethiopia. Descriptive cross sectional study design using multistage random sampling technique was conducted among secondary school students in Akaki Kality sub city, Addis Ababa, Ethiopia from March 01 – 25, 2023. A total of 349 students proportionally allocated to five schools in Akaki Kality sub city were interviewed and focus group discussion were conducted with five catchment health center immunization focal persons.

In this study, preparatory students had 44.6% knowledge and 17.5% practice regarding COVID 19 vaccination. Religion, residence, and the educational level of students' parent were found associated with students' knowledge on vaccination against COVID 19. Previous COVID 19 illness and knowledge of students were found to be associated with students' vaccination practice against COVID 19.

In comparison to other studies, relatively limited knowledge and poor practice were observed. Knowledge was found to be associated with students' practices indicating the need for strengthening behavioral, risk communication and community engagement activities using religious leaders and different communication platforms. Additionally, to address vaccine related shortages, partnerships should be strengthened at different levels to enable direct purchases, utilization of group financing and donation options.

Keywords: Vaccination against COVID 19; COVID 19; Assessment; Preparatory students; Akaki Kality sub city; Addis Ababa

1. Introduction

Coronavirus (COVID-19) pandemic is an infectious disease caused by the SARS-CoV-2 virus. COVID 19 can attack anyone and became seriously ill or die at any age. The World Health Organization (WHO) declared COVID-19 as a global pandemic on March 11, 2020 [1]. Since then, as of Dec 30,2022, a total of 229 countries and territories affected with the worldwide total number of COVID-19 cases reached to 664, 982,762 and deaths hit 6,699,871 (Case fatality rate of 1%).

The best way to prevent and slow down transmission is by staying at least 1 meter apart from others, wearing a properly fitted mask, washing hands frequently, getting vaccinated and following local guidance.

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Vaccination is one of the most preventive strategies against infectious diseases. A vaccine is a live or attenuated antigen used to stimulate antibody production improve immunity against pathogens like bacteria and viruses.

Global vaccination programs have saved up to 2–3 million lives each year by stimulating the immune system to protect the host against potential pathogens and significantly reducing the burden on global health and economy. In addition to providing individual protection, Vaccination programs help establish population or herd immunity.

Herd immunity is established by immunizing a large proportion of the population to protect non vaccinated, immunologically native, and immunocompromised individuals by reducing the percentage of vulnerable hosts to a level below the transmission threshold [2]. Assuming that the basic reproductive number (R_0) of the SARS-CoV-2 virus is three (one infected individual infects three new individuals), a threshold value of approximately 67% is estimated to be sufficient for achieving herd immunity against SARS-CoV-2. Based on this estimate, close to 5.3 billion or 12–16 billion vaccine doses are required for a single dose or a multi-dose vaccine, respectively [2,3]. Inducing herd immunity at the population or community level through mass vaccination would be a powerful tool to contain the COVID-19 pandemic, despite the significant challenges in implementation [2,4]. As covid-19 continues to spread across the world, vaccines were developed within the shortest period (one year following declaration as an international public health emergency) due to remarkable determination in vaccine research, development, and production. In December 2020, the first dose of a fully tested vaccine manufactured by Pfizer/BioNTech was administered in the United Kingdom. Now, multiple vaccines have been authorized for use around the world and dozens of countries and territories have joined the race to vaccinate their residents. The current widely available COVID 19 vaccines efficacy ranging from 24% to 97% [5].

Nowadays, countries are continuing to work towards vaccinating at least 70% of their populations by prioritizing the vaccination of 100% of health workers and 100% of the most vulnerable groups, including people who are over 60 years of age and those who are immunocompromised or have underlying health conditions. The Ministry of Health (MOH) and Ethiopian Public Health Institute (EPHI), in collaboration with partners, have intensified response efforts to prevent the spread and severity of Corona Virus Disease 2019 (COVID-19) in Ethiopia. A total of 667 days has elapsed since Ethiopia started to administer the first dose of COVID 19 vaccine. As of January 19, 2023 a total of 52,509, 414 doses of COVID 19 vaccines administered. From the targeted population 29.8% are fully vaccinated, and 5.2% partially vaccinated [6].

Like any other vaccination program, the success of any COVID-19 vaccination program will depend on public willingness to receive the vaccination [7]. Even though one of the most effective ways of controlling infectious diseases like COVID-19 is through vaccination, resistance to uptake by people and communities is often challenging for successful vaccination and to control its spread. These challenges for COVID-19 vaccine acceptability currently exist in some parts of the world, including Africa [8].

In sub-Saharan Africa, adolescents aged 10 to 19 years make up 23% of the population. Therefore, getting COVID-19 vaccines into the arms of adolescents is crucial to achieve the World Health Organization's target of COVID-19 vaccination coverage. Furthermore, adolescents may serve as advocates to encourage their family members and friends to get vaccinated [9].

These vaccines, however, cannot curb the epidemic without widespread acceptance. With the development of multiple effective vaccines, reducing the global morbidity and mortality of COVID-19 will depend on the distribution and acceptance of COVID-19 vaccination. According to WHO, vaccine hesitancy, defined as the delay in acceptance or refusal of vaccines, as one of the top ten threats to global health, even prior to the current COVID-19 pandemic [10].

COVID 19 is a fatal, serious, and highly contagious disease transited primarily from human to human through direct contact and respiratory secretions, resulting in the loss of more than seven thousand five hundred people's life in Ethiopia, as well as socioeconomic and psychosocial crisis [11]. The morbidity and mortality from COVID-19 are much lower in adolescents than in adults, with the most vulnerable group being aged 65 years and older. However, since infected adolescents can still transmit the virus to others, and some adolescents do develop severe symptoms and complications from COVID-19, vaccinating the adolescent population has the dual benefits of protecting adolescents against morbidity and mortality while reducing the spread of the virus by promoting herd immunity [12–14]. Following introduction of Vaccines against COVID 19, the uptake is different among different age groups.

Despite the development of successful SARS COV-2 vaccine (more than 60) within a short period and continuing vaccine supply, vaccine hesitancy, which is quite dominant in Africa, including Ethiopia, offers an opportunity for a COVID-19 re-outbreak. WHO also listed vaccine hesitancy as one of the top ten threats to global health [15]. Young adults, owing to their sense of invulnerability, are at risk of being infected with COVID-19, transmitting the infection to others, and

being super spreaders. Additionally, students share classrooms, different facilities like toilet and cafeterias, play sports in school settings; they have a higher number of social contacts than others. The established COVAX facility is advocating for equitable distribution of vaccines despite there is existing unmet need between demand and supply for COVID 19 Vaccines. Supply is also constrained by cost of vaccines, prioritization by higher income countries and production capacity. Vaccination for those above 12 years started in Ethiopia recently (during 3rd round vaccination program), and previous studies in the country focused on the general population and health care settings. Therefore, assessing the implementation of Vaccination against COVID 19 among these population groups is important to strengthen vaccine uptake, public health interventions and promote better health.

1.1. Empirical review of vaccination and vaccination against COVID 19

Vaccination is one of the most preventive strategies against infectious diseases. For example, a global immunization coverage of more than 80% against smallpox virus has reduced the transmission rates to uninfected individuals to such low levels that the virus has been eradicated. For measles, 91–94% of a population must be vaccinated to achieve herd immunity and prevent new measles outbreaks. Similarly, target set for global eradication of polio virus is 80-85% herd immunity. These indicates that the threshold for vaccination induced herd immunity is pathogen specific.

The current widely available COVID 19 vaccines efficacy ranges from 24% to 97% [5].

COVAX is the vaccines pillar of the Access to COVID-19 Tools (ACT) Accelerator. The ACT Accelerator is a ground-breaking global collaboration to accelerate the development, production, and equitable access to COVID-19 tests, treatments, and vaccines. Under the established global distribution plan from the COVID-19 Vaccines Global Access facility, Ethiopia is receiving different doses of COVID 19 vaccines [16,17].

COVID-19 vaccines are safe and effective in adolescents. However, studies in high-income settings show the concerning issue of COVID-19 vaccine hesitancy among adolescents [18].

Vaccine hesitancy of adolescents poses a challenge to the global effort to control the COVID-19 pandemic. Based on the health belief model, the likelihood of receiving COVID-19 vaccines may be affected by various factors, such as perceived threats from COVID-19 infection, evaluation of COVID-19 vaccines, cues to action received from the media and other individuals and modifying sociodemographic characteristics. Behaviors toward vaccines may also be driven by cultural, social, historical, and political factors, which likely vary across cultural and geographical settings [19].

Global survey on 19 countries to determine potential acceptance of COVID 19 vaccines indicates that 71.5% of participants reported that they would be very or somewhat likely to take a COVID-19 vaccine. Acceptance rate ranges from less than 55% (in Russia) to almost 90% (in China). In the study, respondents reporting higher levels of trust in information from government sources were more likely to accept a vaccine and take their employer's advice to do so [8]. This study limitation is that it was conducted in the context of a highly dynamic and changing landscape, with daily variations in perceived disease threat and COVID-19 vaccine development.

A vaccine acceptance study in Africa indicates several factors like types of health promotion activities and/or messages, community sensitization to dispel myths and misconceptions, endorsements and buy-ins from local champions, celebrities, authorities, logistic considerations and incentives to health counsellors/workers to create demand for efficient roll-out to achieve massive uptake by the targeted population [20]. The potential limitation of these study is that the study areas were selected based on existing connections and infrastructure (mobile phone), and the adolescents in each area were not selected probabilistically, so the finding may not be generalized to adolescents. However, they provide important insights into the prevalence of determinants of COVID-19 vaccine hesitancy in sub-Saharan Africa.

A study on COVID-19 vaccine hesitancy and its determinants among sub-Saharan African adolescents indicate that the percentage of COVID-19 vaccine hesitancy in urban Addis Ababa is 37%. The study indicated that the leading reasons for hesitancy are mainly due to the perceived low necessity, concerns about vaccine safety, and effectiveness [7].

If recommended by health workers, over 60% of Nigerians are willing to take the COVID-19 vaccines. Different factors like sex being male, religion, ethnicity, and geographical location to health facilities positively influence the willingness of Nigerians to get vaccinated against COVID-19 vaccines [21]. The study lack stratification to include some formal groups of the general population.

A study conducted in Ethiopia to assess the willingness of the population and its determinants to receive COVID 19 vaccines indicated that only 31.4% were willing to take the COVID-19 vaccine. In the study, being female, age between

less than 25 and 26 – 30, urban residence, being university/college student were more likely willing to take COVID-19 than their counterparts [21]. Since this online survey was conducted just before the beginning of the vaccination program in Ethiopia, its findings might not reflect the current situation after the vaccination program is established. A systematic review of other studies also highlighted that there was no consistent association with participants' demographic variables (age and sex) with vaccine uptake behavior [22].

The study will help to determine the knowledge and practice of preparatory school students' vaccination against COVID 19, which will assist catchment health facilities and public health experts in understanding COVID 19 vaccine acceptance at school level.

The currently new variants of the COVID virus are putting unvaccinated people at greater risk of getting sick, so the study will help COVID 19 vaccination program implementers to understand the status at the school level, ensuring sustained vaccine supply and program efficacy for implementation.

Objective

The general objective of the study was to assess implementation of Vaccination against COVID 19 among preparatory school students in selected secondary preparatory schools in Akaki Kality Sub city, Addis Ababa, Ethiopia

2. Methods and materials

2.1. Study area and period

The study was carried out in Akaki Kality sub city, which is one of the eleven sub cities of Addis Ababa, the capital city of Ethiopia from March 01 to 25, 2023. The sub city is situated at southernmost area of the city and borders Bole sub city in the north, Nifasilk lafto sub city in the west, Oromia in the south and East. Geographically, the sub city is located at 8.89 °N in latitude and 38.79 °E in the longitude, with an altitude ranging from 2000m to 2800 m above sea level. The sub city has a total population of 255,348 with 52% females, residing in an area of 118.1 km². The population density is 2163/km² [23]. The majority of the residents in the sub city are factory workers, daily laborers, people working in urban agriculture, civil servants, and military personnel. Among these, factory workers and civil servants constitute the largest population segment. Additionally, there are ten secondary and preparatory public schools in the sub city.

2.2. Study design

A descriptive cross sectional study design conducted from 1st to March 25th, 2023.

- Target population: All preparatory students in Akaki Kality sub city (N = 7,550)
- Study population: Students enrolled in selected secondary and preparatory public schools with in Akaki Kality sub city
- Study unit: Preparatory students

2.3. Eligibility criteria

- Inclusion criteria: All preparatory students aged 18 years and above who are capable of actively participating in interview sessions by listening and responding to questions
- Exclusion criteria: Those who are unable to listen to and respond to interview questions

2.4. Sample size determination

Calculation of sample size was done by using a single population proportion formula [24]. Given a prior study indicating a 31.4% willingness to take COVID-19 vaccine in Ethiopia [17], we used these proportion (p) to determine the maximum sample size of our study.

$$n = \frac{(Z \alpha/2)^2 * P (1 - P)}{d^2}$$

Were,

n = Sample size, z = 1.96 (with 95% confidence level),

p= prevalence estimate (31.4%), q = (1-p), d = Sampling error (0.05).

The initial sample size was 331. Since the number of public preparatory school students is below 10,000, we utilized the finite population correction formula to determine the final sample size.

$$n_{final} = \frac{n}{1 + \frac{n}{N}}$$

Where n_f = final sample size

n = initial sample size

N = Number of public-school preparatory students in Akaki Kality sub city (7550)

These becomes 317. By adding a 10% non-response rate, the final sample size becomes $348.7 \approx 349$.

2.5. Sampling technique, data collection tool and procedure

A multistage sampling technique was utilized to select study participants. First, the Addis Ababa city administration was stratified in to eleven sub cities, considering the reference population. Akaki Kality sub city was selected, and all ten preparatory schools in Akaki Kality sub city was then listed, from which five (50%) chosen by lottery method. Subsequently, the total sample of 349 individuals was proportionally allocated to five secondary and preparatory public schools. Students were then identified through simple random sampling from the list of students in classroom.

From the total of ten secondary and preparatory public schools in the sub city, five (Tulu Dimtu, Fitawerari Abayeneh, Derartu, Ethio Japan and Gelan Secondary and Preparatory school) were drawn through lottery method. The total sample size of 349 students was then allocated to these schools based on the proportional method.

Table 1 Proportional allocation of students to schools, March 2023

S.no	Name of Secondary and preparatory school	Total number of students	Number of proportionally allocated students
1	Tulu Dimtu Secondary and preparatory school	1037	87
2	Fitawerari Abayeneh Secondary and preparatory school	820	69
3	Derartu Secondary and preparatory school	925	78
4	Ethio Japan Secondary and Preparatory school	595	50
5	Gelan Secondary and preparatory school	776	65
Total		4,153	349

Data were collected by ten trained health care students and two supervisors through interviews using structured questionnaire. The data collectors received a one day theoretical and practical training session to familiarize themselves with the study objectives and the questionnaires. Special emphasis was placed on establishing mutual trust, sources of bias, and interview techniques. Attention was given to questionnaires requiring careful handling. The overall data collection was coordinated by the investigator, who also conducted a review of reports from five catchment health facilities and held two focus group discussions with immunization focal persons from these facilities.

2.6. Data quality control

Questionnaires were carefully designed and pre- tested on 5% of the sample size from secondary and preparatory school in Akaki Kality Sub city, which were not selected initially for the study. Necessary corrections to the questionnaire were made after the pre-test to ensure clarity and understanding before the actual data collection. Data collectors and supervisors was trained on the study objective, sources of bias, observation, and interview techniques. Data quality was assured by using the standardized pre-tested questionnaire with data collectors and supervisors. Questionnaires were checked for completeness daily by immediate supervisors. Each questionnaire was manually cleaned up for

completeness, missed values and inconsistent of responses. Frequencies and cross tabulations utilized to check missed values and variables. Errors identified was corrected after revising the original questionnaire.

2.7. Data processing and analysis

All survey questionnaires responses were coded against the original English version, and data was entered into Epi info 7.2.5.0. The final data file was exported to SPSS version 25 for analysis. Recoding and re-categorizing were performed for selected relevant variables. Descriptive statistics using cross-tabulation were used to calculate Chi square (X^2) and correlation of association.

The strength of association between variables measured using odds ratio as Odds ration quantify the effect of a predictor in terms of a log-odds ratio using maximum likely hood estimates. The odds ration can be crude, predicting the strength of association between a single predictor and the outcome variable, or adjusted, predicting the association strength of more than one predictor variable with controlling confounding variables (25,26).

2.8. Ethical consideration

Ethical clearance was obtained from Skill Mart International College ethical review board. A formal letter from the college was submitted to Addis Ababa education bureau and Akaki Kality sub city education office, explaining the studies' purpose, and requesting permission and support letter from all concerned bodies. At the time of data collection, the studies purpose was explained to participants, and verbal consent was obtained to ensure their willingness to participate. Those who did not volunteer to participate was given the right to decline. Confidentiality of responses was ensured throughout the research process.

3. Results

3.1. Socio-demographic characteristics of study participants

A total of 332 preparatory school students were interviewed and included in the analysis with 95% response rate. One hundred seventy-five (52.7%) of the respondents were female with mean (\pm SD) age of 22.28 (3.8) years (Table 3).

Table 2 Socio demographic characteristics of selected preparatory school students (n= 349)

Socio demographic Characteristics	Frequency	Percent (%)
Sex		
Female	175	52.7
Male	157	47.3
Age (Years)		
18-24	247	74.4
25-30	70	21.1
31 and above	15	4.5
Religion		
Muslim	79	23.8
Orthodox Christian	135	40.7
Protestant	118	35.5
Residence		
Inside Addis Ababa	177	53.3
Out of Addis Ababa	155	46.7
Parents Educational level		
Below grade 4	3	0.9

Grade 4- 8	63	19
Grade 8 -12	63	19
Grade 12 – Diploma	123	37
Diploma & above	80	24.1
Monthly family income		
Less than 2000	3	0.9
2000-3500	104	31.3
3500-5000	142	42.8
Above 5000	83	25
Previous confirmed COVID 19 illness		
Yes	132	39.8
No	200	60.2

Source: Student's socio demographic SPSS descriptive statistics analysis output, June 2023

3.2. Knowledge level of students

One hundred forty-eight (44.6%) of students have satisfactory knowledge on vaccination against COVID 19 practice

Table 3 Assessment result of students' knowledge towards vaccination against COVID 19 practice (n = 332)

Statement	Response	
	(In number and percent)	
	Correct answer	Incorrect answer
Do you know that COVID 19 can be prevented by Vaccines?	205(61.7%)	127 (38.3%)
Do you have information about the presence of COVID 19 vaccines?	295(88.9%)	37 (11.1%)
If yes, where did you get the information first?	295(88.9%)	37 (11.1%)
Do you know that these discovered vaccines are safe for utilization?	158(47.6%)	174 (52.4%)
Do you know that vaccination increase immunity?	161(48.5%)	171 (51.5%)
Do you know that vaccines reduce severity & illness against COVID 19 illness?	81(24.4%)	251 (75.6%)
Who should be vaccinated?	179 (53.9%)	153 (46.1%)
Total students who have satisfactory Knowledge	148(44.6%)	

Source: Students COVID 19 vaccination knowledge SPSS descriptive statistics analysis output, June 2023

3.3. Practice level of students

Fifty-eight (17.5%) of the students have good practice towards vaccination against COVID 19.

Table 4 Assessment result of students' practice to wards vaccination against COVID 19 practice (n = 332)

Statement	Response	
	(In number and percent)	
	Correct answer	Incorrect answer
Do you take at least two doses of COVID 19 vaccine previously?	77(23.2%)	255 (76.8%)
If yes, where did you receive it (does it include static and outreach facilities)?	77(23.2%)	255 (76.8%)
if not vaccinated, do you have interest to be vaccinated?	66(19.9%)	266 (80.1%)
Do you recommend the vaccines to your family and relatives?	121(36.4%)	211 (63.5%)
If not recommend, is it because of one of cultural beliefs, low perception on vaccine, fear of side effects?	212 (63.8%)	120(36.2%)
Do you remember a vaccination campaign in your school previously??	62(18.6%)	270 (81.4%)
Total students who have good practice	58(17.5%)	

Source: Students COVID 19 vaccination practice SPSS descriptive statistics analysis output, June 2023

3.4. Qualitative result

Two session key informant interviews conducted with catchment health facilities immunization focal persons of the selected schools; the result indicated that two catchment health facilities utilize outreach sites including schools to provide vaccination service. Others prioritize the service at facility level because of the limited vaccine availability and operational cost to run outreach sites.

All health facilities received vaccines through the health system and the major source (95%) is donation from different partners, bilateral and multilateral organizations. Four (80%) of the participant ranked that these is mainly because of in country financial constraint to purchase vaccines, limited vaccine production capacity, prioritization of vaccination for developed countries and limited vaccines supply to developing countries like Ethiopia.

Record review also indicated that a total of 279,384 doses of different COVID 19 vaccines distributed to the catchment health facilities and 66,430 individuals received at least two doses of COVID 19 vaccines. As of 13 May 2023, a total of 1,928 doses of vaccines available in the health centers. All facilities don't have sufficient stock of COVID 19 vaccines because of limited vaccine availability.

3.5. Factors associated with knowledge of students

On cross tabulation statistical analysis each set of variables analyzed with knowledge and practice of students against COVID 19 vaccination. Candidate variables with a chi-square value of below 0.25 considered as a cut-off point for multivariate analysis. Accordingly, during the bivariate cross tabulation analysis; age, sex being male, religion being Muslim and Orthodox, residence being inside Addis Ababa, parents' educational level of grade 4 - 8 & 8 -12, and previous COVID 19 illness found positively associated with vaccination against COVID 19 knowledge of students.

On multivariable cross tabulation analysis; religion, residence and parents' educational level were statistically associated with vaccination against COVID 19 knowledge of students.

Vaccination against COVID 19 knowledge were 2.39 times higher among Muslim students (AOR:2.39; 95%CI:1.19 – 4.47, P<0.05). Similarly, the odds of vaccination against COVID 19 knowledge were 2.1 times higher among Orthodox students (AOR:2.1; 95%CI:1.13 – 3.91, P<0.05). Vaccination against COVID 19 knowledge were 2.1 times higher (AOR:2.1; 95%CI:1.16 – 3.81, P<0.05) among Addis Ababa resident students and parents' educational level of grade 4-8 were 3.49 times higher vaccination against COVID 19 knowledge (AOR:3.49; 95%CI:1.24 – 9.8, P<0.05) (

Table 5).

Table 5 Factors associated with knowledge of students to wards vaccination against COVID 19 (n = 332)

Variable	Knowledge		COR (95% CI)	AOR (95% CI)
	Satisfactory	Unsatisfactory		
Age group				
18-24	127	120	0.35 (0.19, 0.63)	2.68(0.55, 13.1)
25 - 30	19	51	0.14 (0.32, 0.66)	1.66 (0.32, 8.6)
31 and above [1]	2	13	1	1
Religion				
Muslim	44	35	3.24 (1.78, 5.89)	2.39(1.19, 4.47)
Orthodox	71	64	2.86 (1.69, 4.83)	2.1 (1.13, 3.91)
Protestant [1]	33	85	1	1
Residence				
Inside Addis Ababa	113	71	4.02 (2.52, 6.39)	2.1 (1.16, 3.81)
Out of Addis Ababa [1]	42	76	1	1
Parent education level				
Below grade 4	0	3	-	-
Grade 4 - 8	45	18	4.9 (2.39- 10.0)	3.49 (1.24, 9.8)
Grade 8 - 12	37	26	2.79 (1.11, 5.53)	1.39(0.59, 3.25)
Grade 12 – diploma	39	84	0.9 (0.5, 1.66)	1.29(0.63, 2.61)
Diploma and above [1]	27	53	1	1
Family income				
Below 2000	3	0	9144 (.00,)	749 (.00,)
2000 – 3,500	24	80	0.17(0.09, 0.32)	0.61(0.21, 1.76)
3,500 – 5000	68	74	0.52(0.29, 0.9)	1.58 (0.68,3.67)
Above 5000 [1]	23	30	1	1

Source: Students COVID 19 Vaccination knowledge SPSS multivariate cross tabulation analysis result, June 2023

3.6. Factors associated with practice of students

On bivariate cross tabulation analysis; religion being Muslim and orthodox; residence inside Addis Ababa; parents' educational level of grade 4 - 8 & 8 -12; previous COVID 19 illness and knowledge of students found positively associated with Vaccination practice of students while monthly family income found negatively associated with practice. On multivariate cross tabulation analysis; Knowledge and previous exposure to COVID 19 illness are found associated with practice of vaccination practice of students.

Vaccination against COVID 19 practice of students were 2.67 times higher among those who had previous COVID 19 illness (AOR:2.67; 95%CI:1.25 – 5.74, P<0.05) and those who had satisfactory knowledge of vaccination against COVID 19 were 13.37 higher practice (AOR:13.37; 95%CI:4.47 – 39.98, P<0.05) (Table).

Table 6 Factors associated with practice of students to wards vaccination against COVID 19, (n = 332)

Variable	Practice		COR (95% CI)	AOR (95% CI)
	Good	Poor		
Religion				
Muslim	64	15	1.7 (0.78, 3.84)	0.84 (0.28, 2.46)
Orthodox	106	29	2.03 (1.02, 4.06)	1.16 (0.44, 3.06)
Protestant [1]	104	14	1	1
Residence				
Inside Addis Ababa	45	142	3.7 (1.92, 7.2)	1.67 (0.66, 4.24)
Out of Addis Ababa [1]	13	132	1	1
Parent education level				
Below grade 4	0	3	-	-
Grade 4 - 8	24	39	4.85 (2.05- 11.4)	2.15(0.52, 8.82)
Grade 8 - 12	17	46	2.9 (1.19, 7.09)	1.59 (0.44, 5.7)
Grade 12 – diploma	8	115	0.54 (0.2, 1.48)	0.08 (0.24, 2.93)
Diploma and above [1]	9	71	1	1
Family income				
Below 2000	3	0	335 (.00,)	1.17 (.00,)
2000 – 3,500	4	100	0.08(0.02, 0.24)	0.64(0.12, 3.36)
3,500 – 5000	24	118	0.42(0.22, 0.79)	1.10 (0.39,3.13)
Above 5000 [1]	27	56	1	1
Satisfactory	54	94	25.85(9.1, 73.56)	13.37(4.47,39.98)
Unsatisfactory [1]	4	180		

Source: Students COVID 19 Vaccination practice, SPSS multivariate cross tabulation analysis result, June 2023

4. Discussion of the study

The results indicated that the mean age of respondents was 22.28, which is close to a study conducted in Godar City [27], lower than an e-survey study conducted in Ethiopia [28] and higher than a study conducted on sub-Saharan African adolescents [7]. This difference can mainly be attributed to variations in socio-demographic characteristics and the source population.

The result of students' knowledge towards vaccination against COVID-19 is close to a study conducted in Northwest Ethiopia and lower than college students in Gondar City [27]. The variation might be due to differences in setting and education levels, where the latter group may have better access to information. Religion was found to influence students' knowledge, with Muslim and Orthodox Christian students having 2.39- and 2.1-times better knowledge of vaccination against COVID-19, respectively, compared to Protestants. This result is consistent with studies conducted in Ethiopia and the USA [29,30]. Students living in Addis Ababa have 2.1 times better knowledge compared to those living outside Addis Ababa, possibly due to limited access to information and education channels. Students whose parents' have an educational level between 4 and 8 grades have 3.29 times greater knowledge than students whose parents have a diploma or higher education level. This result contradicts a study in Ethiopia [15,31] which might be due to the prioritization of behavioral change activities for vulnerable groups.

In this study, less than one-fifth of the students demonstrated good practice regarding vaccination against COVID-19. This result is lower than studies conducted in Addis Ababa, Uganda, and globally [32–34]. This could be due to differences in perception among high school, college, and medical students who may receive information about the

COVID-19 vaccine during their courses. Additionally, in Ethiopia, COVID-19 vaccines were recently administered to population groups aged 12 and above during the third-round distribution, which might limit vaccine prioritization efforts and initiatives by the government, leading to mistrust and perceived threats about the COVID-19 vaccine among the study population. Previous COVID-19 illness and knowledge are found associated with students' COVID-19 vaccination practice, consistent with other studies in Northwest Ethiopia and Addis Ababa [15,33].

Students or their close relatives who had a history of COVID-19 illness were found to have 2.67 times better vaccination against COVID-19 practice than those who did not. This might be due to access to information during the illness period or fear of the disease's consequences. Students with satisfactory knowledge were found to have 13.37 times better vaccination against COVID-19 practice than those with unsatisfactory knowledge, consistent with a study in Ethiopia [35] and a study in developed countries like the USA, indicating that sufficient vaccine-related knowledge has a positive effect on vaccination intention by decreasing perceived susceptibility [36]. This could be because students' knowledge about COVID-19 vaccine effectiveness and safety is likely to increase their knowledge and positive attitudes towards vaccination.

Out of those who have not received the COVID-19 vaccination, 35% are interested in getting vaccinated. However, the demand for the vaccine and its availability are not proportional. From the available stock of the last year to the latest distribution to the catchment health facilities, the available doses can serve 1,928 students with one dose or two doses for 964 students. African countries rely on developed countries to obtain vaccines, and they also compete to leverage their purchasing power in order to secure vaccine doses for their own citizens, leaving vulnerable nations behind. Currently, countries have the option to access newly developed COVID-19 vaccines, including through direct purchase, group financing, and donations [37].

5. Conclusion

In comparison to other studies, regardless of any demographic characteristics, the overall level of students' knowledge is like that of other studies, yet poor practice towards vaccination against COVID-19 is observed. Students exhibited unsatisfactory knowledge regarding the safety of discovered vaccines and the efficacy of vaccines in reducing the severity of illness caused by COVID-19. This indicates that students have limited access to information, orientation, and engagement to enhance their knowledge of vaccination against COVID-19.

Students possess good knowledge regarding the availability of COVID-19 vaccines, with the top three main sources of information being healthcare workers, social media, and TV or radio. However, students' practice towards vaccination against COVID-19 is low, with more than one-third of students neither receiving nor recommending the COVID-19 vaccine to their close relatives or friends due to cultural beliefs, low perception of the vaccine, or fear of vaccine side effects. A limited number of unvaccinated students' express interest in COVID-19 vaccination. Currently, even though students have limited vaccine demand, the available stock is insufficient to achieve herd immunity and bolster prevention efforts.

Those who have good knowledge of COVID-19 vaccination exhibit better vaccination practices, highlighting the need to enhance students' vaccine-related knowledge through school and community-based education programs. Less than one-fifth of the students recall school-level COVID-19 vaccination campaigns, indicating that schools were not prioritized as outreach sites. There is a limited amount of in-country financed vaccines available to the community, necessitating continuous financing and agreements with manufacturers.

6. Recommendation

Based on the findings the researcher recommends:

- Schools
 - To enhance students' knowledge about vaccination against COVID-19, it is important to engage school-based health education programs and utilize school media
 - School health clubs to facilitate opportunities for COVID-19 vaccination
- Catchment health facilities
 - To enhance students' knowledge, it is important to engage facility immunization focal persons, implement school-based health education programs, and utilize school media
 - Prioritization of school-based outreach sites to create behavioral change that can address the misperceptions and administer vaccines

- Engagement of different religious, school-based parent and teacher associations to strengthen behavioral change activities
- Ministry of Health (under different structures)
 - Strengthening adolescent focused COVID 19 vaccination key message transmission through different communication platforms (medias like TV, radio, social media) by engaging trained media personnel's
 - To ensure the continued access to COVID 19 vaccines, the government shall strengthen bilateral and multilateral partnership with different partners including vaccine producers.
 - Strengthening efforts and initiatives by the government to halt mistrust, perceived threats about the COVID-19 vaccine among students.
 - Strengthening school-led promotion of COVID 19 vaccination to improve vaccine confidence, provide support and readiness for current and future pandemics
- Researchers
 - To further exploit the impact of vaccination against COVID 19 on the health of adolescents and general population

Compliance with ethical standards

Disclosure of conflict of interest

The researchers declare conflict of interest none.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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