COLLEGE OF MEDICINE AND HEALTH SCIENCES

DEPARTMENT OF EMERGENCY MEDICINE

KNOWLEDGE, ATTITUDE, AND PRECAUTIONARY MEASURE TOWARDS COVID-19 AMONG MEDICAL STUDENTS IN ADDIS ABABA, ETHIOPIA, 2021

By: Asegid Mekonnen (BScN)

A THESIS RESEARCH RESULT SUBMITTED TO ADDIS ABABA UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES DEPARTMENT OF EMERGENCY MEDICINE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN EMERGENCY MEDICINE AND CRITICAL CARE NURSING

Oct, 2021

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Approval Sheet

This is to approve that a thesis result entitled on **Knowledge, attitudes, and precautionary measure towards covid-19 among medical students in Addis Ababa, Ethiopia 2021,** which will be submitted to the department of emergency medicine in the partial fulfillment of master of emergency medicine and critical care nursing has been carried out by Asegid Mekonnen under my supervision. Therefore, I recommend that the student has fulfilled the requirement and hence hereby can submit the result to the AAU Department of Emergency.

Advisors:	**Signature**	**Date**
Dr. Hywet Engida (EMCCS)	_____	_____
Instructor Mebrat Michael (EMCCN)	_____	_____

Examiners:

DECLARATION

I Asegid Mekonnen Ergete declare that this thesis research entitled on **Knowledge, Attitude, and Precautionary measures towards COVID-19 among medical students in Addis Ababa** is my original work produced under the support of my advisors Dr. Hywet Engida, and Instructor Mebrat Michael and has never been published for any award of Diploma or Degree in any other University.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to individuals and organizations for supporting me throughout my Graduate study. The first and most gratitude go to Hawassa University Comprehensive Specialized Hospital for sponsoring me to attend my graduate study in Emergency medicine and Critical Care Nursing. Furthermore, after recognizing Addis Ababa University for acceptance, I would like to precise my acknowledgment to my advisors Dr. Hywet Engida and Instructor Mebrat Michael for their valuable supports during my thesis research write-up and valuable guidance and comments throughout the whole research process.

ACRONYMS AND ABBREVIATIONS

AA	Addis Ababa
AAU	Addis Ababa University
AU	African Union
CHS	College of Health Science
CoV	Corona Virus
COVID	Corona Virus Disease
EC	Ethiopian Calendar
GDP	Gross Domestic Product
HCoV	Human Corona Virus
KAP	Knowledge, Attitude, Practice
MERS	Middle East Respiratory Syndrome
PI	Principal Investigator
SARS	Severe Acute Respiratory Syndrome
SPMMC	Saint Paul's Millennium Medical College
USA	United States of America
UNCTAD	United Nations Conference on Trade and Development
WHO	World Health Organization

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ABSTRACT

Background: COVID-19 is a respiratory tract infectious disease caused by severe acute respiratory syndrome, coronavirus 2 (SARS-CoV-2), which is the offspring of the strain SARS-CoV-1 that caused the outbreak of SARS infection from 2002 to 2004. As of December 15, 2020 world health organization global aggregate report 70 million and 1.6 million COVID-19 morbidities and mortality were registered respectively. Meanwhile, the burden of the situation has resulted in the health system's shortage of health care workers, and in this context, the participation of medical students on the front line is obligatory. In addition, as with any section of of the society, it is important to evaluate the knowledge, precautionary measure, and attitude of medical students as long as they are at risk. Therefore, applicable training regarding COVID-19 is an urgent prerequisite that universities and health systems may assure.

Objective: The objective of this study was to assess the knowledge, attitude, and precautionary measure towards COVID-19 among medical students in Addis Ababa, Ethiopia 2021.

Methods: A cross-sectional study was conducted in randomly selected Addis Ababa medical schools on a sample size of 371 students. The data was collected from April to May, 2021, using pretested and structured self-administered questionnaire. Fully completed data were entered into Epi-Data manager V-4.6 and were exported to SPSS V-26 for further analysis. Finally, the data was computed as means, standard deviation, and summarized as frequencies and proportions. Association between independent and dependent variables was assessed using bivariable and multivariable logistic regression, and P-Value <0.05 was considered as statistically significant.

Result: A total of 349 students participated in the study with a response rate of 94.1%. Among the participants 207 (59.3%) were males, and the mean age was 23.13 ± 2.61 years. The study revealed that good knowledge of medical students was 37.8%, positive attitude level 30.4%, and uses of precautionary measures regarding COVID-19 45%. Students who were in Clinical-II were 2.9 times more likely to have good knowledge towards COVID-19 than those who were in Pre-Clinical-I (P=0.02).

Conclusion: In this study area medical students have lower knowledge, attitude, and precautionary measures towards COVID-19 compared to other studies, and it requires intensive work of the government and other stakeholders to improve their KAP status..

Keywords: COVID-19, Medical Students, Addis Ababa

1. INTRODUCTION

1.1 Background of the study

COVID-19 is an infectious disease of the respiratory tract caused by severe acute respiratory syndrome, coronavirus 2 (SARS-CoV-2), which is the inheritor of the strain SARS-CoV-1 that caused the outbreak of SARS from 2002 to 2004. In Wuhan, China, the first SARS-CoV-2 infection was reported after some Huanan Seafood Market workers showed up symptoms of viral pneumonia and it is an infection declared as a pandemic by the world health organization on 11 March 2020 (1–3).

Since the study of human coronavirus progressed superfluous coronavirus was identified which encompasses SARS-CoV in 2003, HCoV NL63 in 2003, HCoV HKU1 in 2004, MERS- CoV in 2013, and SARS-CoV-2 in 2020 (5). In Sept 2012, one of those coronavirus mentioned above was identified in the Middle East and officially named as Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Subsequently, the transmission from human to human was confirmed in France and Tunisia after two confirmed cases that acquired the disease from their late father who becomes infected after visiting Qatar and Saudi Arabia where 124 cases and 52 deaths were reported. In December 2019 the largest outbreaks of MERS-CoV have occurred beyond the Middle East were 2468 cases of MERS-CoV infection confirmed by laboratory tests which of 851 were lethal (4,6)

The fatality rates for the three popular viruses SARS-CoV-1, MERS-CoV and SARS-CoV-2 coronaviruses are 9.5%, 34.4%, and 2.3%, respectively (7). The SARS-CoV-2 infection is highly infectious and mainly spreads from person to person through close contact and sneezing or cough-induced respiratory droplets. For this reason, the virus transmits very quickly from person to person, making it difficult to track (3). COVID-19 morbidity and mortality continued to increase with an aggregate of 70 million and 1.6 million deaths globally since the start of the pandemic as of December 15, 2020. From the world, America and Europe account for 85% of new cases and 86% of new deaths (7).

The first COVID-19 case was introduced from China, Wuhan in late December 2019. Overall as of December 18, 2020, there have been 95,375 confirmed cases of COVID-19 with 4,764 deaths.

China currently reports minimum or zero cases per day and it is one of the countries that successfully controlled the transmission (8) However, China has faced a major reduction of GDP drop by 6.8% since 1992. The collapse has seen a high in unemployment in China. In January and February 2020 about 5 million people lost their jobs and were estimated to rise to 80 million by the end of March (9).

As of December 18, 2020, in the United States, there have been greater than 17,300,000 confirmed cases and 313,000 COVID-19 related deaths, the most cases, and deaths among other countries with the mortality rate of 950 per one million people, and ranked tenth highest rate of death among nations (10,11) The US economy constricted 4.8% from January through March 2020 and the unemployment rate increases to 14.7% in April (12). The total health care costs of handling the epidemic advances from 34 billion dollars to 250 billion dollars according to analysis from the New York Times (13)

Africa as of December 17, 2020, WHO report has registered 1,657,336 cumulative cases and 24,464 COVID-19 deaths from 47 countries (14,15) Generally, the impact of COVID-19 varies across African countries. The fall in request and price of fuels is the major apprehension for Africa. Hence, a paper published by UNCTAD has estimated that the pandemic will hinder the African economy by 1.4% in GDP. Another study that analyzed the impact of COVID-19 in Africa has projected government revenue to drop by 45 billion dollars annually, an average annual debt to increase more than 4.4% of GDP expected in 2020 (16).

Ethiopia was reported the first coronavirus case on March 13, 2020, and induced the national government to declare a five-month state of emergency on April 8, 2020 (17,18). As of December 19, 2020, Ethiopia has reported 119,025 cumulative cases and 1,843 COVID-19 related deaths (19,20). To contain the spread of the disease and manage the disaster in hospitals human resource remains vital and medical students may receive a call from the government, so assessing their knowledge, attitude and precautionary measure towards the COVID-19 is critical.

1.2 Statement of the problem

Education is one-pieces that impacted by the COVID-19 pandemic across the world. Schools and universities were completely closed and the face-to-face training and lecture teaching methods were diverted to the virtual teaching-learning method. For this reason, medical education which requires clinical practice and simulation is a majorly affected department. As articles from the US, medical education is affected through canceling in-person medical classes, clinical clerkships, and medical conferences (21). The COVID-19 has also directly affected the psychosocial status of the medical students. According to a study conducted in Turkey, Istanbul medical students showed that not knowing COVID-19 ways of transmission and preventive measures were significantly associated with anxiety (25).

The overflow of patients; newly opened COVID-19 treatment centers without the addition of health care workers have overstrained health professionals throughout the world and result in a lack of human resources to manage the pandemic. As a consequence different countries involved medical students in the management of the C0VID-19 pandemic. According to articles released in journals and newspapers the countries like Italy, the United Kingdom, and the United States of America have let medical students graduate early and involved them in the care of COVID-19 patients(23,24). Ethiopia is one of the developing countries yet has not fulfilled the minimum threshold of health professionals to a population ratio set by the world health organization (WHO) for sub-Saharan Africa which is 2.3 health workers (MD, Nurses, and Midwives) per 1000 population. The health care workers per population ratio of Ethiopia in 2016 is 1.5 per 1000 population which is remarkably below the minimum standard of WHO (25).

Considering the manpower shortage as many countries were done in the era of the COVID-19 pandemic medical students may receive a call from the Ethiopian government to work in the emergency. Inadequate knowledge and negative attitudes among medical students can directly influence practices and lead to delayed diagnosis, poor infection control practice, and the spread of the disease. Bestowing to the knowledge of the principal investigator there are no studies conducted on medical students to assess their knowledge, attitude, and precautionary measures towards COVID-19 in Ethiopia. Therefore, this study aims to assess the level of knowledge, attitude, and precautionary measures of medical students towards COVID-19 among medical schools in Addis Ababa, Ethiopia.

1.3 Justification and Significance of the study

COVID-19 is a highly contagious disease and current public health issue of the world. To minimize the workload of frontiers and contain the spread of the disease, it is important to involve medical students in the process of controlling the pandemic. This study conducted among medical students has provided baseline information on knowledge level, attitude level, and precautionary measures of medical students towards COVID-19 for policymakers in the College of Health Science and School of Medicine in Addis Ababa as well as for NGO'S working with medical colleges. Likewise, for future researchers, it is also baseline information to compare their study. Besides, as the study is the minimum requirement for the degree of master's in emergency medicine and critical care nursing the principal investigator has a profit from the study.

The principal investigator hasn't accessed any studies conducted to assess the knowledge, attitude, and precautionary measures of medical students towards COVID-19 in Ethiopia. Even though medical students are frontiers in the COVID-19 pandemic across some parts of the world, they are learners and uncertified practitioners. Furthermore, regardless of their educational status, they are dealing with COVID-19 cases in the clinical stage which may increase the number of unnecessary risks for patients, for the communities, and as well as for themselves, where they are exposed to an infection that they would not typically come upon during their medical education. Hence, it is strongly believed that assessing their level of knowledge, level of attitude and precautionary measures towards COVID-19 is important to get ready medical students for the situation of emergencies like SARS-CoV-2 pandemic. However, to the best of our knowledge, there are no studies conducted on the issue. Therefore, this study fills this gap in Ethiopia and serves as a reference for future researchers.

2 LITERATURE REVIEW

2.1 Knowledge level of medical students regarding COVID-19

A web-based cross-sectional study conducted in Turkey, Istanbul on a total number of 275 medical students showed that a significant difference was found in terms of anxiety between knowing and not knowing the ways of transmission and prevention of COVID-19 infection (p=0.02) (26).

A cross-sectional study designed to assess COVID-19 related knowledge among a total number of 872 undergraduate medical and non-medical students in Shaanxi Province, China has shown that appropriate knowledge was acquired by 82.34% of students and the level of knowledge was significantly higher in students from public school universities as well as medical students (22).

According to a descriptive cross-sectional online study performed in Jordan, to assess knowledge, attitude, perceptions, and precautionary measures towards COVID-19 among 1404 sample medical students described the source of transmission 42.5% said animals, 53.3% contaminated food and 38.6% thought fecal-oral route as a source of transmission, while 91.0% were sure that the virus is likely transmitted through inhalation of infected droplets, and 95.0% students respond that chronic illness is the most risk factor for COVID-19 (27).

Another descriptive multi-centered study which was conducted to assess knowledge level and perceptions toward COVID-19 among Turkish final year medical students on 860 participants showed the median knowledge level Score of the participant was 69.0 (0–93.1) and the knowledge level of the participant was moderate, while 34.2% of the participants had a high level of knowledge, 8.2% had a low level of knowledge (28).

Based on an online survey conducted on 309 Ecuadorian final year medical students the median COVID-19 knowledge score was 17 points out of a possible 23 points. The vast majority of participants (88.0%) attained a high knowledge score (≥16). Out of the 309 respondents, 8.0% scored 20–23 of 23 possible knowledge points, 80.6% scored 16–19 points, and 11.4% scored 12–15 points (29).

A descriptive cross-sectional study conducted in Uganda on 741 first to fifth medical students reflected that an enormous number of the medical students had sufficient knowledge score (91%) on COVID-19 main clinical symptoms, transmission, and prevention (30).

An institution-based cross-sectional study which was conducted in western Ethiopia, Gonder from the mid of March to the end of April 2020 among 408 health care workers regarding COVID-19 knowledge and attitude, the Good Knowledge was found to be 73.8% (31).

According to another web-based study conducted in Ethiopian health professionals working in public hospitals presented that knowledge of the source of COVID-19 infection ($\beta = 3.53$, $P < 0.01$), knowledge of the mode of disease transmission ($\beta = 7.51$, $P < 0.01$), knowledge of the incubation period ($\beta = 11.33$, $P < 0.01$), and knowledge of the presence of curative treatment for COVID-19 ($\beta = 8.1$, $P < 0.01$) found to be independent predictors (32).

In a cross-sectional study conducted in Addis Ababa, Ethiopia on community pharmacists, most participants (92.2%) identified old ages as one of the high-risk groups for complications and deaths from COVID-19, while 89.5% suggested supportive treatment and life support as management options to date. According to the survey, greater than half (53.2%) of the respondents were found with sufficient knowledge about COVID-19 (33).

1.2 An attitude of medical students towards COVID-19

A similar study which was done on 872 undergraduate medical and non-medical students in Shaanxi Province, China universities have revealed females showed significantly higher levels of positive attitudes than males towards COVID-19 ($p<0.05$) (22).

In the descriptive cross-sectional study done in Jordan medical students proved that 67.1% of the students believed 90.0% of patients would recover without the need for medical treatment, and 75.0% of participants thought that an effective vaccine would halt COVID-19 spread, and, the majority of respondents said that if a person has the virus, should be quarantined accordingly (83.3%) and, some students notified that this person's family should also be isolated 76.9% (27).

According to a similar study done in Turkish final year medical students, 64.7% reported worrying that their medical education had not adequately prepared them to deal with COVID-19, while 50.7% stated that they would feel happy if they were called to work in the emergency department. Of the respondents, 2.1% were worried about infecting their relatives, and 1.3% feared they would become infected with COVID-19 (28)

Among the Ecuadorian medical students that participated in the study more than one-half of respondents had a negative attitude toward volunteering at a health facility during the COVID-19 outbreak (57.9%), and a majority of students reported that they did not have confidence that Ecuadorian health facilities and Ecuador, in general, could win the battle against COVID-19 (70.9% and 77.0%, respectively) (29).

In the cross-sectional study of the 741 medical students in Uganda, 74% had a positive attitude toward COVID-19 prevention. According to the study, 80% of the participants were willing to participate in the management of patients with COVID-19 when called upon. However, 32% were not confident that Uganda would contain the pandemic. In the study, female medical students also significantly had more negative attitudes (P=0.04) toward COVD-19 prevention than male students (30).

In a cross-sectional study conducted in western Ethiopia health professionals, a positive Attitude towards COVID-19 among the participants was found to be 65.7%. Among the study participants, 88.5% were not interested to be involved in the treatment of COVID-19 patients, and 90% responds they will not accept isolation in health facilities if they get infected with COVID-19 (31).

According to a similar study conducted in Addis Ababa community pharmacists, of the participants, 89.8% had a good attitude towards the importance of ensuing WHO recommendations in controlling the spread of COVID-19, while 81.0% agreed that they or members of their family could acquire COVID-19 in some time in the future. Regarding healthcare institutions, only 9.8% had confidence in the capacity of the healthcare facilities in the country to properly handle potential COVID-19 outbreak, and the study demonstrated the overall percentage of positive response to the attitude questions was 54.1% (33).

1.3 Use of Precautionary measures towards COVID-19 among medical students

According to the study in Shaanxi Province, China showed the proactive practice was found in 87.94% of participants and there was a positive correlation between attitude and precautionary measures ($r=0.319$, $p<0.05$) in the total participants (22).

A survey conducted in Jordan was also assessed COVID-19 related precautionary measures of the students. Conferring to the study regular hand washing, personal hygiene, and staying at home were the three most adopted strategies by the students to protect themselves from becoming infected (>80.0%). According to the study, the proportion of students that reported never wearing a mask as a protective measure against COVID-19 was greater among students in the first three academic years (64.3%) in contrast to their equivalents in the last three clinical years of study (56.1%) (27).

According to the study conducted in Uganda medical students, only 57% (n=426 of 741) had good use of precautionary measures towards COVID-19 and the mean practice score was 11.8 (SD 1.9) indicating moderately good practices. The majority of the students had maintained a social distance, abstained from shaking hands, and washed hands before touching their face (30).

According to a web-based cross-sectional study conducted in Ethiopian public hospitals regarding the precautionary measures, the lowest mean scores were wearing gloves (1.82 ± 1.15), followed by wearing a mask (2.54 ± 1.82). Avoiding while people sneeze or cough had the highest mean score (4.0 ± 1.06) (32)

The cross-sectional study done in Addis Ababa stated that among the WHO-recommended COVID-19 preventive measures, hand washing was exercised by 97.3% of the study participants (33).

1.4 Factors associated with medical student's knowledge, attitude, and precautionary measures towards COVID-19

A study from Jordan has identified a statistically significant relationship between the use of disinfectants and the year (level) of study of students. Students in the last three (clinical) years were more likely to use disinfectants (72.8%) compared to students in the first three (academic) years of study (66.1%) as a protective measure against getting infected (27).

According to a study conducted on Ecuadoran medical students, the univariate and multivariate analysis showed that not having personal protective equipment was associated with a lack of willingness to volunteer in a health facility during the COVID outbreak (OR 4.07, $p < 0{\cdot}01$); that male sex (OR 0.55, $p = 0.03$), not having personal protective equipment (OR 2.92, $p = 0.01$), and not having pieces of training (OR 3.07, $p < 0.01$), were associated with the feeling of the health facility not being prepared. Further, not having personal protective equipment was associated with the feeling that Ecuador will not control the outbreak (OR 2.70, $p = 0.03$) (29).

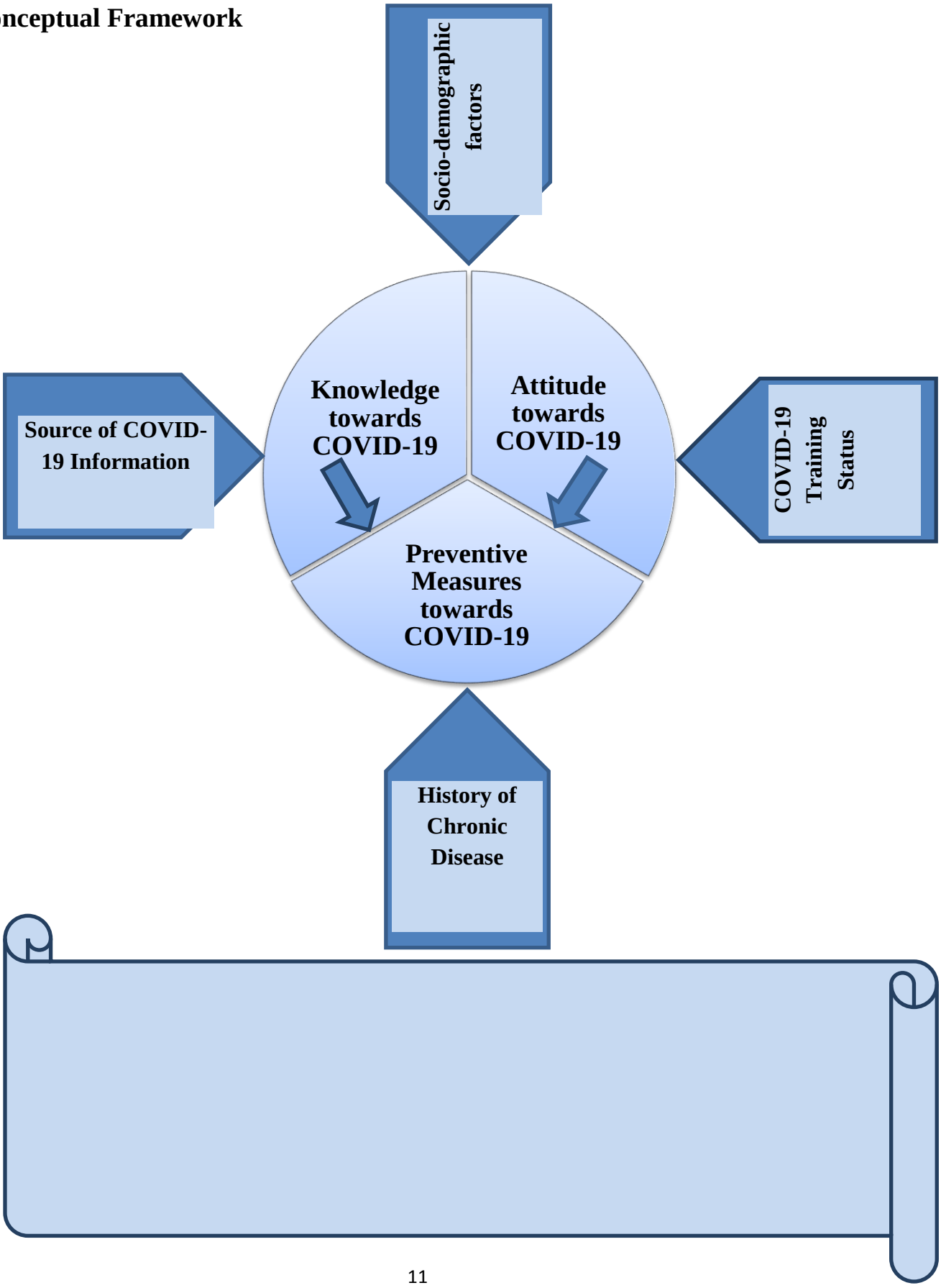
A descriptive cross-sectional study conducted in Uganda on 741 first to fifth medical students who used journals or articles (P=0.03) and websites (P=0.03) as a source of information significantly had sufficient knowledge than students who use other sources. Furthermore, fourth-year medical students had more sufficient knowledge than their first-year counterparts (P<0.01). On logistic regression bivariate analysis, sex (P=.04), academic program (P=.04), and information source of mass media (P=.01) significantly affected attitudes of medical students on COVID-19 prevention. Those who obtained information on COVID-19 using mass media (television and radios) were twice more likely to have a positive attitude than their counterparts who used other sources (P=0.01). Similarly, to the participants, older medical students had better practices compared to students younger than 24 years of age, and students who took online courses on COVID-19 also had better practices than others on multivariate analysis (30).

Conferring a cross-sectional study conducted in western Ethiopia the odds of having a positive attitude towards COVID-19 infection was 3.17 times higher among health care workers having good knowledge of COVID-19 [AOR: 3.17; 95%CI (1.97, 5.06)] than providers with poor knowledge towards COVID-19. Bestowing the study odds of having good knowledge towards COVID-19 were 2.85 times higher among Health care providers having master degree [AOR: 2.85; 95% CI (1.25, 6.00)] as compared with health care providers holding diplomas (31).

In another study conducted on Ethiopian public hospital health workers, participants who knew the causes of COVID-19 infection had 3.53 times more likely to exercise protective behavioral practice. Correspondingly, health care workers who knew of the incubation period of COVID-19 were 8 times more likely to apply suggested protective behavioral practices (32).

The cross-sectional study done in Addis Ababa stated that inadequate protective measures were taken to protect the staff from COVID-19 in the institutions of 70.2% of participants, and the major reason associated with this was resource scarcity. Moreover, 69.5% of participants stated that their institution did not provide adequate service related to COVID-19, primarily due to the limited supply of equipment or pharmaceuticals (33).

Conceptual Framework



3 OBJECTIVES

3.1 General Objective

To assess Knowledge, Attitude, and Precautionary measures towards COVID-19 among medical students in Addis Ababa, Ethiopia, 2021.

3.2 Specific Objectives

- To assess the level of knowledge towards COVID-19 among medical students in Addis Ababa.
- To assess the level of attitudes towards COVID-19 among medical students in Addis Ababa.
- To assess the use of precautionary measures towards COVID-19 among medical students in Addis Ababa.
- To identify factors affecting knowledge, attitude, and use of precautionary measures towards COVID-19 among medical students in Addis Ababa.

4 METHODS AND MATERIALS

4.1 Study area and period

The study was conducted in selected medical schools in Addis Ababa from April to May, 2021. There are about eight medical schools in Addis Ababa. Of which three are public, and five are private.

University College of Addis Ababa was founded in 1950 and renamed “Addis Ababa University" in 1962. The university is the oldest school of higher education in Ethiopia. Under the university, there are thirteen campuses. This college of health, sciences is located in the Lideta sub-city along with Black Lion Hospital. CHS was established in 2009/10. It is comprised of four schools and one teaching hospital. The four schools are the School of Medicine, School of Pharmacy, School of Public Health, and School of Allied Health Science. The CHS currently has over 5000 students(34).

St Paul’s Millennium Medical College, as it is known today, was established in 2010, and the medical school opened in 2007. It is located in Addis Ababa, Gulele Sub-City, and is governed by a board under the Federal Ministry of Health. The college has more than 2800 clinical, academic and administrative, and support staff that provide medical specialty services to patients who are referred from all over the country, teaching medicine and nursing students and doing basic and applied researches(35)

Yekatit12 Hospital was established in 1923 as one of the modern medical service delivery centers in the country. After many decades of medical service delivery, in 2011, it became a medical College by a decision of the City Government of Addis Ababa. It is administered by the Addis Ababa city administration health bureau and has greater than 265 beds.

The hospital has 9 major departments and 6 units and the college of health science is one of the departments where medical students progress. Since 2020, the hospital was a candidate for innovative medicine and was annually receiving 50 to 100 NIME students per year (36)**.**

Africa Medical College is a pioneer private health institution in Ethiopia, working in the course of training qualified health professionals. To this end, the college has strengthened and branched out its services from Technical and Vocational Educational Training to Degree and Master's programs. The College is currently employed on the first degree and Master's program and teaches General Public Health, Nursing, Pharmacy, Public Health, Medical Laboratory Sciences, Medical Radiologic Technology, Doctor of Dental Medicine, and Doctor of Medicine (MD) (37).

Bethel Medical College, founded in 2004, is a well-recognized private health college serving students in Addis Ababa, Ethiopia. It educates and trains Ethiopian doctors, nurses, health officers, and other key medical personnel with accreditation from the Ethiopian Ministry of Education, it is one of the private colleges in the country that offer the Medical Doctor Degree program in Ethiopia (38).

Hayat Medical College is another private higher education institution in Ethiopia. The college was founded in 2005, and the main campus is located at the heart of the capital of Ethiopia, Addis Ababa. Hayat Medical College is in the top five universities of Ethiopia according to the national rankings, despite being one of the youngest educational institutions in the country (39)

4.2 Study Design

An institution-based cross-sectional study design was implemented.

4.3 Source population

The source populations of this study were all medical students in Addis Ababa.

4.4 Study population

The study populations of this study were students of selected medical schools in Addis Ababa.

4.5 Eligibility Criteria

Inclusion criteria

All medical students in pre-clinical level, clinical attachment, and internship who are willing and able to participate in the study were included in this study.

Exclusion criteria

Medical students who are not available during data collection and not willing to participate in the study were excluded from the study.

4.6 Sample size determination

The sample size for the study was determined by using a single population proportion formula.

$$n = \frac{z\left(\frac{\alpha}{2}\right)2 \ p(1-p)}{d2}$$

Where:

n = estimated sample size

Z = Confidence level (alpha, α)

a = Level of significance

P = prevalence

d = marginal error

Therefore, the assumption is:

z (alpha/2) the reliability coefficient 95% i.e. 1.96,

The proportion (p) of good knowledge towards COVID-19 is 53.2% which is taken from a previous related study conducted in Addis Ababa community pharmacists (33).

$$n = \frac{z\left(\frac{\alpha}{2}\right)2 \ p(1-p)}{d2}$$

$$n = (1.96)2(\frac{0.532(1-0.532)}{(0.05)2}$$

$$n = 383$$

Considering the finite population correction, where N = (2798)

The final correction formula

n = $[\frac{n \times N}{n+N}]$ Plus 10% of n for non-respondents

n= 383 * 2798

383+2798

n= 337+34

n= 371

4.7 Sampling technique

Based on the total number of medical students in each institution, a proportional number of students were selected from each medical school by using a simple random sampling technique. To select the study area all the medical schools in Addis Ababa were listed, and among them, 6 medical schools (3 governmental and 3 private) were chosen by lottery method. Correspondingly, the sampling frame for the participants was obtained from the study areas in respect of their clinical year, and finally randomly selected individuals by the lottery method were involved in the study. According to current data, St.PMMC has 623, AAU 1090, Yekatit12 medical college 189, Africa medical college 221, Bethel medical college 304, and Hayat medical college has 371 medical students.

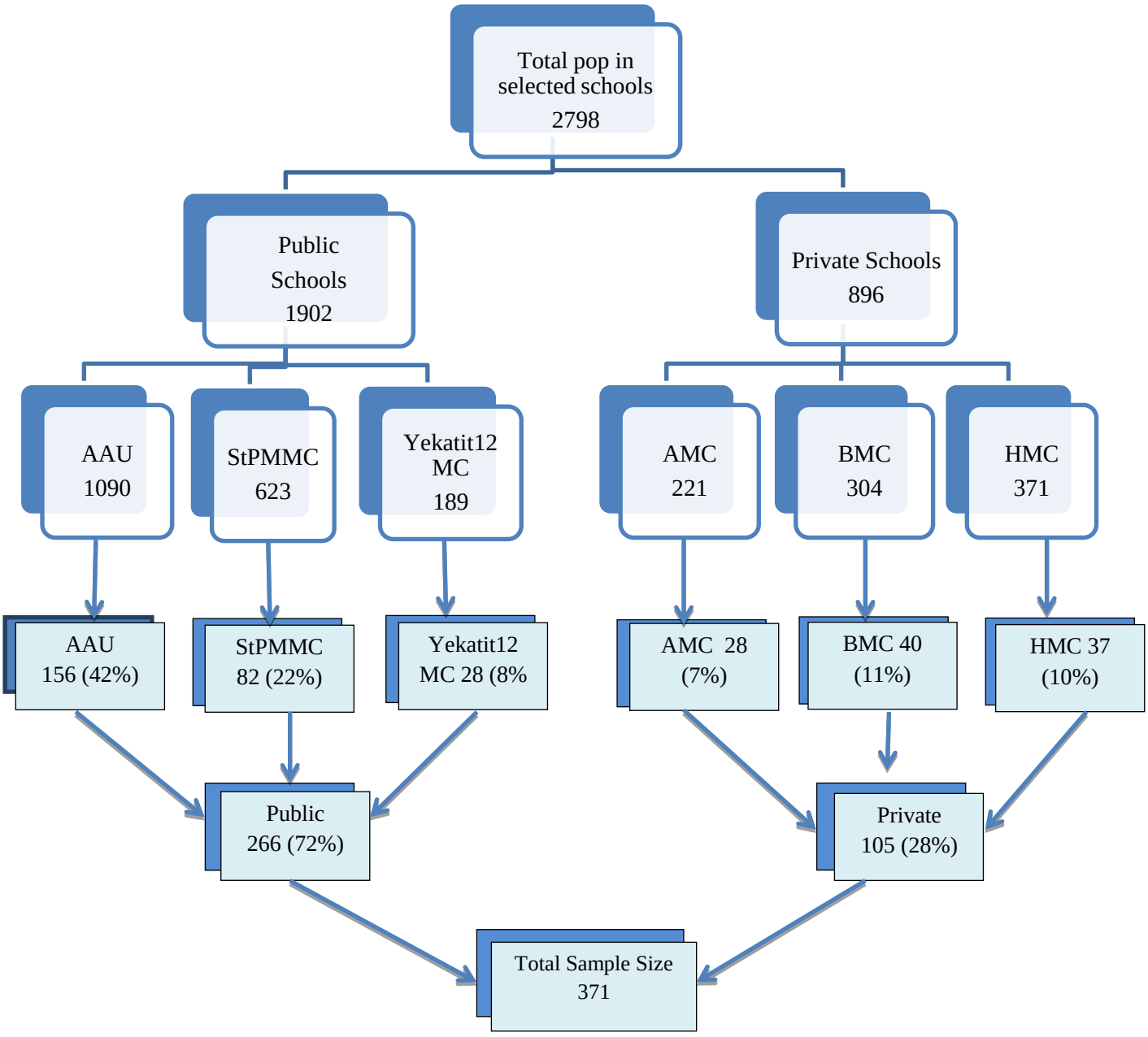


Figure 1 Schematic Presentation of sampling procedure, and proportional allocation

4.8 Study variables

4.8.1 Dependent Variables

Knowledge towards COVID-19

Attitude towards COVID-19

Precautionary measures towards COVID-19

4.8.2 Independent Variables

Age

Gender

Religion

Clinical Stage

Type of University

History of Chronic disease

Source of information

Knowledge level towards COVID-19

Attitude level towards COVID-19

4.9 Oprational Definitions

In this study, Medical students are students of medicine (MD) who are in pre-clinical, clinical attachment, and internship stages. Considering different pieces of literature the cut-off score of the correct response (70%) was used to determine whether the medical students had good knowledge, a positive attitude, and good precautionary measures towards COVID-19. Knowledge was assessed using a 24-item questionnaire adapted from Lincango-Naranjo et al. 2021 (29) and modified to suit the local medical students, where each correct answer weighing 1 point.

The questions were comprised of five domains, such as General knowledge, Diagnosis, Treatment, prevention, and prognosis of COVID-19. The total score was out of 24, and ≥17 (ie, ≥70%) correct responses was considered as good knowledge and less than 17 correct response as poor knowledge.

Attitudes were assessed using 10 item questions with a possible response of "Yes or No" answers. The total score was out of 10, and ≥7 (ie, ≥70%) positive responses were considered a positive attitude towards COVID-19, and those who responded less were measured as negative attitude. Correspondingly, precautionary measures of the medical students towards COVID-19 were assessed using 10 preventive measures regarding COVID-19. The responses were "Yes or No" answers each weighing 1 point for good practice. Among the proposd 10 preventive measure questions four of them were questions related with their institutions and other conditions which probably affect the practice of the students. Bearing this in mind the total score was out of 6, and ≥ 4 (ie, ≥70%) correct responses were considered as good practices, and correct responses less were reflected as a poor precaution.

4.10 Data collection tools

The data was collected by using a pre-tested structured questionnaire which was adapted from published litratures after communicating with respective bodies via emails and acknowledged accordingly (29). The data collectors were selected interns from each school, and they were excluded from the study.

4.11 Data Quality Control

One week prior to the actual data collection, The data collection tool was pre-tested at Hawassa University Comprehensive Specialized Hospital the same level medical students on 5% of the sample size to prove its validity and ability to elicit relevant responses from the study participant. Then in advance of the actual data collection, the questionnaires were reviewed based on the pre-test result. Furthermore, the data collectors were trained regarding the data collection tool. The data quality has also maintained by the supervisor and PI throughout all stages where the assigned supervisor checks the completeness of the questionnaire on the spot and the principal investgators also evaluate the completeness on each day data entery.

4.12 Data analysis

The collected data was checked for its completeness and coded. Fully completed questionnaires were entered into Epi-data statistical software version 4.6, then exported to SPSS version 26 for further analyses. The discriptive result was computed as means, standard deviations, as well as summarized as frequencies and proportions. Associations between independent and dependent variables were assessed using bivariable and multivariable logistic regression. In the bivariable logistic regression variables with P-value <0.25 were included in multivariable logistic regression, then variables with P-value <0.05 were considered statistically significant. Lastly, the result and strength of association were reported as odds of ratios (OR) with their respective 95% level of confidence intervals.

4.13 Ethical Considerations

The study was conducted after ethical letters were obtained from the AAU department of emergency medicine's ethical review committee. Once, the official letter from the committee has been obtained the data were collected with informed and written consent taken from the participants. The participant's name and other identifiers were not written on the data collection tool and the unauthorized person has had no access to the data to keep the confidentiality.

4.14 Dissemination of the findings

The finding of this study was disseminated by using hard copies and soft copies to the AAU department of emergency medicine. Also, the document has been archived in the library of AAU and an effort is continued to publish in journals as a reference for future researchers.

Summary of Methods and Materials

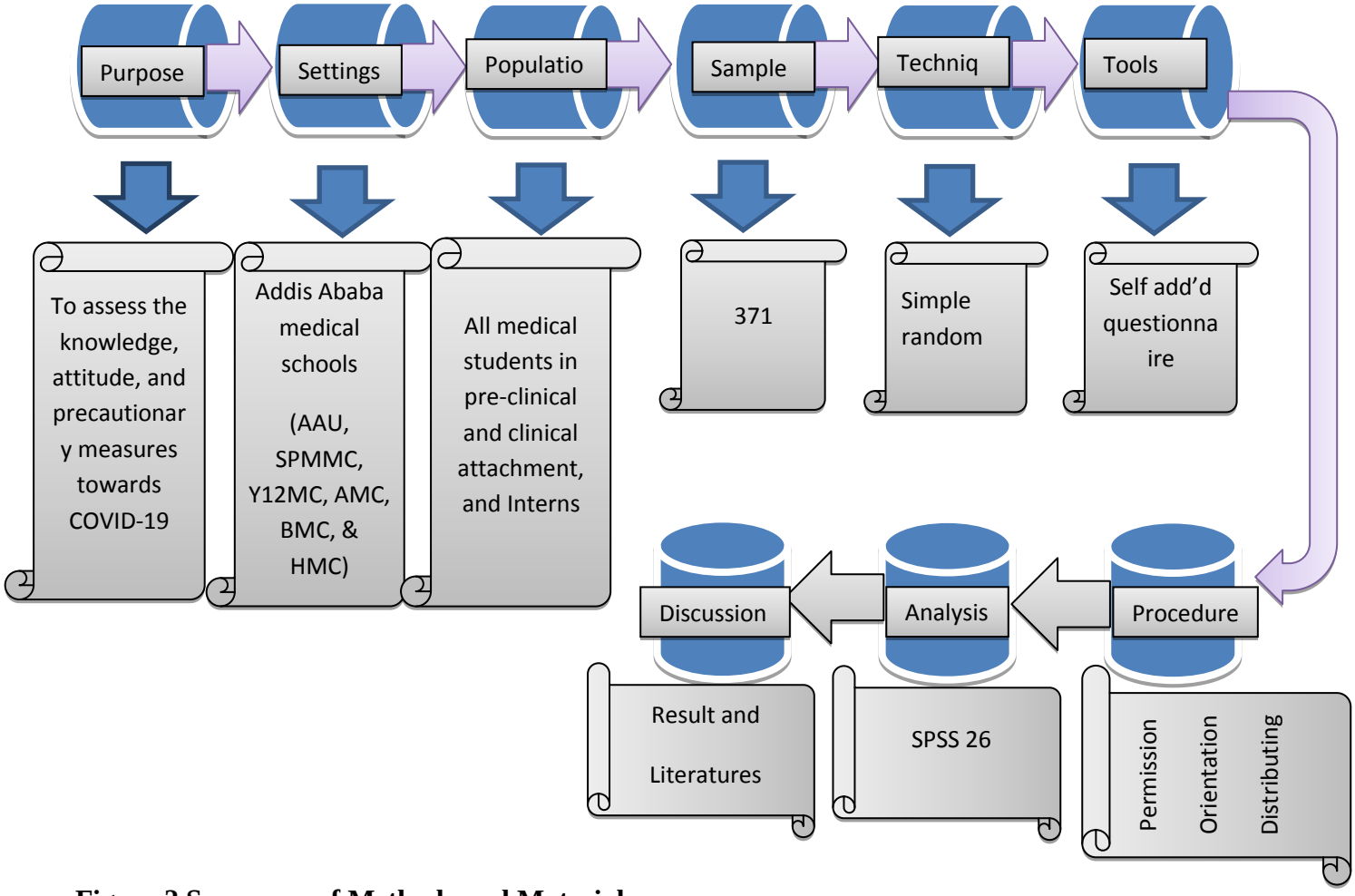


Figure 2 Summary of Methods and Materials

5 RESULT

5.1 Socio-demographics status of the participants

Overall, a total number of 349 medical students were participated in the study with a response rate of 94.1%. The majority 207 (59.3%) of the participants were males and the respondents mean age was 23.13 years with a standard deviation of 2.611 years (Table 1).

Table 1 Socio-demographic characteristics of Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

Variables	Variable Categories	Frequency	Percent
Type of the University	Governmental	253	72.5%
	Private	96	27.5%
Educational Status	Pre-Clinical	127	36.4%
	Clinical	149	42.7%
	Internship	73	20.9%
Age in years	15-20	51	14.6%
	20-25	191	54.7%
	>25	107	30.7%
Sex	Male	207	59.3%
	Female	142	40.7%
Religion	Orthodox	218	62.5%
	Muslim	57	16.3%
	Protestant	59	16.9%
	Others	15	4.0%

Students were also asked about their COVID-19 training status. Among the contestants 126 (36.1%) students had COVID-19 training (Table 2).

Table 2 COVID-19 training status of Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

Variables	Status/Need	Frequency	Percent
Trained for COVID-19	Yes	126	36.1
	No	223	63.9
Needs COVID-19 training	Yes	231	66.2
	No	118	33.8

The study has also assessed the major source of information that the students used to obtain knowledge regarding COVID-19. The majority 162 (46.4%) of the participants, use social media like Facebook, and Twitter as their main information source, while an insignificant number 93 (26.6%) of students utilize PubMed, Up-to-date frequently as COVID-19 information source (Table 3).

Table 3 Source of information related to COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

Information Source	Frequency of use		
	Never n (%)	Rarely/sometimes n (%)	All/Most of the time n (%)
Social Media (Facebook, Twitter, etc.)	50 (14.3)	137 (39.3)	162 (46.4)
Google search (PubMed, up-to-date, and similar sites)	170 (48.7)	311 (89.1)	217 (62.1)
International and local organizations	105 (30.1)	145 (41.5)	99 (28.4)

5.2 Knowledge level of medical students regarding COVID-19

After evaluating the sociodemographic characteristics of the participants the study has also assessed the knowledge status of the students towards COVID-19. Among the participants, only 132 students scored greater than or equal to 70%, and the good knowledge level towards COVID-19 were **37.8%.**

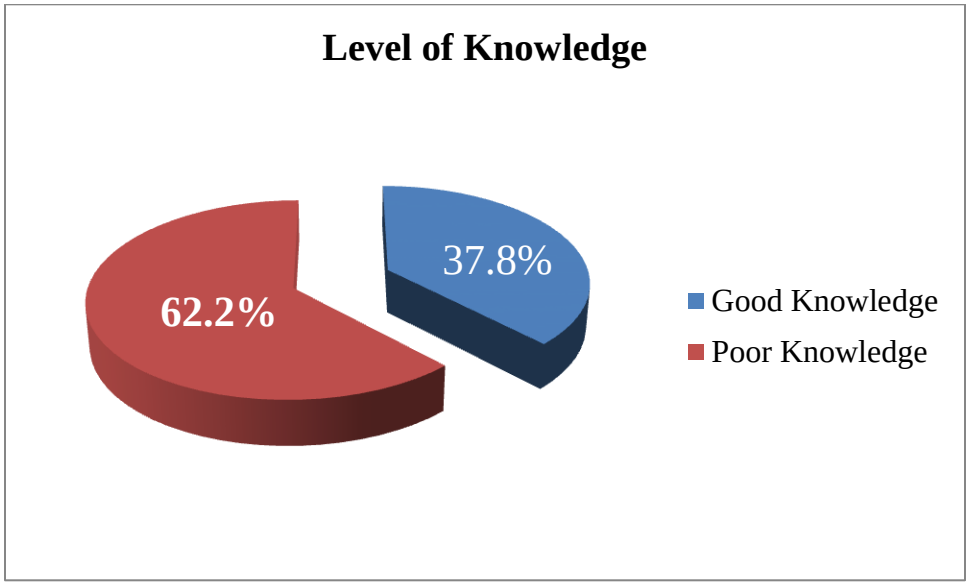


Figure 2 Knowledge level of the participants regarding COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

Regarding detailed knowledge-related questions majority (70.8%) of the respondents don't know the subgenus of SARS-CoV-2, and 76.5% of participants missed the lifetime of the N-95 facemask. Other questions are detailed in Table 4.

Table 4 Knowledge towards COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

	Knowledge domain	Correct Answer	Participants response	
			Correct n (%)	Incorrect n (%)
	General Knowledge			
1	SARS-CoV-2 (the virus that causes COVID-19) is a new coronavirus identified at the end of 2019, and when it infects humans, causes acute respiratory infection.	True	316 (90.5)	33 (9.5)
2	SARS-CoV-2 is a member of the subgenus Sarbecovirus (beta-CoV B lineage)?	True	102 (29.2)	247 (70.8)
3	SARS-CoV-2 can live for some time on some surfaces?	True	309 (88.5)	40 (11.5)
4	Not everyone with COVID-2019 will develop serious cases; rather people who have the following characteristics are more likely to have a serious illness: Age over 65 years, have comorbidities, obese.	True	296 (84.8)	53 (15.2)
5	Being in contact with your pets would lead to SARS-CoV-2 virus infection?	False	130 (37.2)	219 (62.8)
6	SARS-CoV-2 stays in the air for 3 hours.	True	135 (38.7)	214 (61.3)
7	SARS-CoV-2 is transmitted by animals.	True	128 (36.7)	221 (63.3)
	Diagnosis and Treatment			
8	The most prevalent symptoms of COVID-19 are fever, cough, and fatigue.	True	330 (94.6)	19 (5.4)
9	The main incubation period for COVID-19 is 1-30 days?	False	120 (34.4)	229 (65.6)
10	The main transmission mechanism of SARS-CoV-2 is close person-to-person contact between people infected with the virus, whether symptomatic or asymptomatic.	True	311 (89.1)	38 (10.9)
11	The diagnosis for COVID-19 is recommended by the WHO made by a rapid test.	True	150 (43.0)	199 (57.0)
12	The diagnosis for COVID-19 recommended by the WHO is made by the polymerase chain reaction (RT-PCR) test of the nasopharyngeal swab.	True	273 (78.2)	76 (21.8)
13	A suspicious case of COVID-19 is defined as any patient who meets the clinical picture of an acute respiratory syndrome (fever, cough, dyspnea, fatigue), and/or	True	287 (82.2)	62 (17.8)

	epidemiological criteria (being in contact with a suspected or confirmed case of COVID 19, travel or residence in an area with active infections in the last 14 days), but without confirmation by laboratory test.			
14	A confirmed case of COVID-19 is defined as any patient who meets the clinical picture of the acute respiratory syndrome and/or epidemiological criteria confirmed by laboratory testing.	True	296 (84.8)	53 (15.2)
15	There is currently no effective cure for COVID-2019, but early supportive and symptomatic treatment helps most patients recover from infection.	True	315 (90.3)	34 (9.7)
16	The use of antiviral drug remdesivir is recommended as a treatment for hospitalized COVID-19 patients to speed up recovery.	True	140 (40.1)	209 (59.9)
	Prevention and prognosis			
17	Hand hygiene should be performed for more than 20 seconds, mainly handwashing with soap.	True	329 (94.3)	20 (5.7)
18	The personal protective equipment recommended by the WHO, for the care of a suspected or confirmed case of COVID-19, without aerosol-generating procedures, includes hand hygiene, N95 mask, gloves, gown, and protective glasses.	True	298 (85.4)	51 (14.6)
19	The recommendation of the distance between patients and health personnel as far as possible due to the fact that the macroparticles generated by coughs or sneezes spread up to 2 meters away, and therefore are potential virus transporters.	True	312 (89.4)	37 (10.6)
20	The lifetime of the N9-5 mask is 7 days.	False	82 (23.5)	267 (76.5)
21	Isolation is an effective way to reduce the spread of the virus.	True	318 (91.1)	31 (8.9)
22	Patients affected by COVID-19 can recover from the disease.	True	328 (94.0)	21 (6.0)
23	People who recovered from the disease can still transfer or spread the virus.	False	158 (45.3)	191 (54.7)
24	One sick person can transmit the disease to about four other people.	True	235 (67.3)	114 (32.7)

5.3 An attitude of medical students towards COVID-19

Generally, 10 attitude questions were presented for the respondents with the option of yes or no answers. From the attitude questions, the majority of the respondents answered negatively for the questions regarding the ability of Ethiopia to contain the pandemic and the increment of COVID-19 cases beyond the capacity of the local hospitals. Overall, the positive attitude levels of the students towards COVID-19 were only **30.4%.**

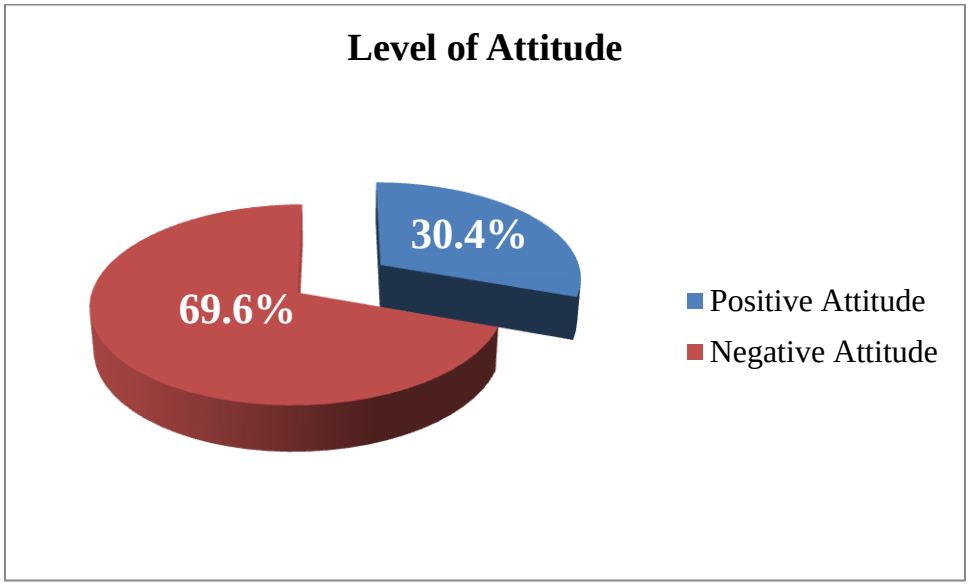


Figure 3 Attitude Levels of the participants towards COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349)

The study has also proposed a question to assess the volunteers of the medical students to be involved in the management of the COVID-19 pandemic if called for help. Among the participants, 81.4% of medical students are willing to volunteer in the health facility during the COVID-19 outbreak. For the question asked to evaluate the student's attitude towards COVID-19 vaccination 23.2% of participants reported that they are not considered the vaccination. Other questions are detailed in Table 5.

Table 5 Attitudes towards COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

	Attitude domain	Participants response	
		Yes n (%)	No n (%)
1	Willing to volunteer at a health facility during the COVID-19 outbreak	284 (81.4)	65 (18.6)
2	Your health facility is prepared for a COVID-19 outbreak	152 (43.60)	197 (56.4)
3	Agree that COVID-19 will be controlled in Ethiopia	129 (37.0)	220 (63.0)
4	You are a potential source of contagion for your family	266 (76.2)	83 (23.8)
5	Agree that following WHO recommendations help to reduce the transmission of COVID-19	327 (93.7)	22 (6.3)
6	Health education can help to prevent the disease	327 (93.7)	22 (6.3)
7	Wearing a face mask regularly prevents getting the disease	301 (86.2)	48 (13.8)
8	Refuse to work with a patient who is a suspect of COVID-19	236 (67.6)	113 (32.4)
9	Consider having a vaccination against COVID-19 if it is available	268 (76.8)	81 (23.2)
10	The number of COVID-19 cases will increase beyond the capacity of our local hospitals	45 (12.9)	304 (87.1)

5.4 Use of Precautionary measures towards COVID-19 among medical students

Good preventive practice towards COVID-19 among the study participants was **45%.** Of the total respondents, 262 (75%) reported that they had no formal conferences and training related to COVID-19 diagnosis, handling of samples, and biosecurity. Other very significant numbers, 248 of 349 (71.1%) of students testified that their frequency of looking for COVID-19 information has significantly reduced compared to the status at the beginning of the pandemic. Table 6 enlightens the precautionary questions presented to the respondents.

Table 6 Precautionary measures towards COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349).

	Practice domain	Participants response	
		Yes n (%)	No n (%)
1	The frequency of looking for information to stay informed about COVID-19 as high as the beginning	101 (28.9)	248 (71.1)
2	You have participated in infection prevention and control (IPC); use, putting on, taking off, and disposal of personal protective equipment (PPE)	159 (45.6)	190 (54.4)
3	During a health care interaction with patients, you remove and replace your PPE according to the protocol (Eg. When medical mask become wet, dispose of the wet PPE in the waste bin, perform hand hygiene, etc)	193 (55.3)	156 (44.7)
4	You apply WHO's "My 5 moments for hand hygiene" (Before touching a patient, before any clean or aseptic procedure, after exposure to body fluids, after touching a patient, and after touching patient surroundings)	211 (60.5)	138 (39.5)
5	Using alcohol-based hand sanitizer after public transportation or other activities?	278 (79.7)	71 (20.3)
6	wearing an N-95 face-mask when entering a room where aerosol-generating procedures performed	161 (46.1)	188 (53.9)

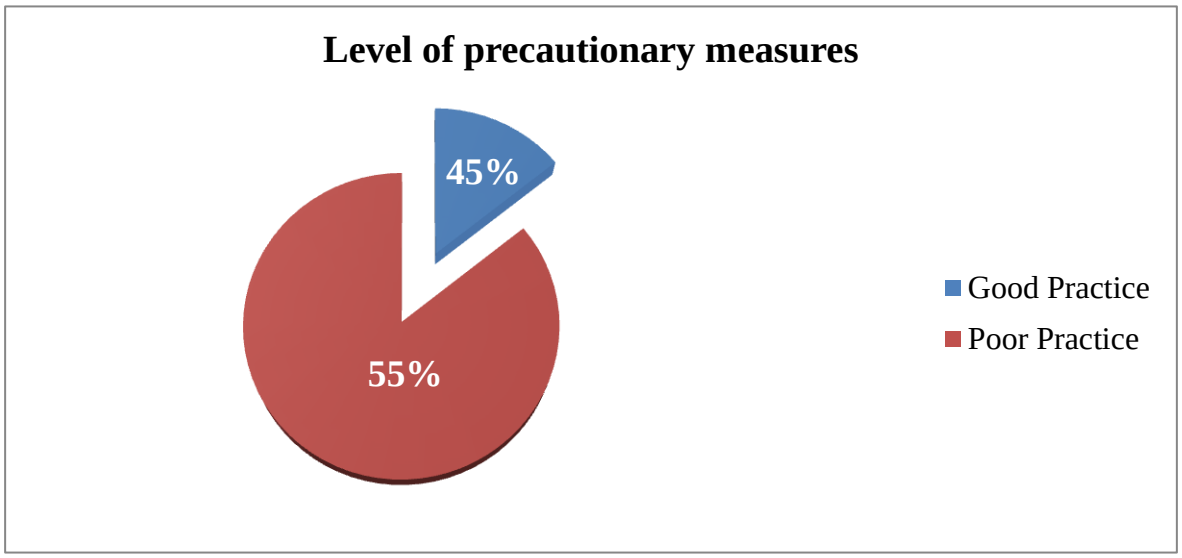


Figure 4 Level of precautionary measures towards COVID-19 among medical students in Addis Ababa, Ethiopia, 2021

5.5 Factors associated with medical students knowledge towards COVID-19

Regarding the factors associated with medical students' knowledge towards COVID-19, participants who are in Pre-Clinical-II were 2.9 times more to have good knowledge towards COVID-19 than those who are Pre-Clinical-I (AOR [95%] =2.932 [1.188, 7.236]).

Furthermore, The odds of good knowledge towards COVID-19 were 3.1 times higher among medical students in Clinical-I than those students in Pre-Clinical-I (AOR [95%] = 3.127 [1.255, 7.789]). Other variables which were a candidate for multivariable binary logistic regression, and not significantly associated with participants' knowledge are shown below in Table 7.

Table 7 Factors associated with knowledge towards COVID-19 among Medical students in Addis Ababa, 2021 (n=349).

Variables		Level of Knowledge		P-Value	95% CI		P-Value
		Poor	Good		COR	AOR	
Educational Status	Pre-Clinical-I	45 (20.7%)	8 (6.1%)		1	1	
	Pre-Clinical-II	45 (20.7%)	29 (22.0%)	0.004	3.625 (1.496,8.784)	2.932 (1.188,7.236)	**0.020***
	Clinical-I	44 (20.3%)	32 (24.2%)	0.002	4.091 (1.698,9.854)	3.127 (1.255,7.789)	**0.014***
	Clinical-II	43 (19.8%)	30 (22.7%)	0.002	3.924 (1.620,9.507)	3.449 (1.383,8.600)	**0.008***
	Internship	40 (18.4%)	33 (25.0%)	0.001	4.641 (1.921,11.211)	2.929 (1.109,7.734)	**0.030***
Age in years	18-23	145 (66.8%)	68 (51.5%)	0.005	1	1	0.170
	>23	72 (33.2%)	64 (48.5%)		1.895 (1.217,2.952)	1.438 (0.856,2.417)	
Sex	**Male**	**116 (53.5%)**	**91 (68.9%)**	**0.005**	**1.933 (1.226,3.046)**	**1.709 (1.052,2.777)**	**0.030***
	Female	**101 (46.5%)**	**41 (31.1%)**		**1**	**1**	
Trained for COVID-19	Yes	70 (32.3%)	56 (42.4%)	0.056	1.547 (0.989,2.420)	1.341 (0.833,2.157)	0.227
	No	147 (67.7%)	76 (57.6%)		1	1	
Wants COVID-19 training	Yes	134 (61.8%)	97 (73.5%)	0.025	1.717 (1.069,2.757)	1.555 (0.950,2.547)	0.079
	No	83 (38.2%)	35 (26.5%)		1	1	

5.6 Factors associated with the level of attitude towards Covid-19

On the theme of factors associated with medical students level of attitude towards COVID-19, participants who want COVID-19 related training were 1.87 times more likely to have a positive attitude compared to those students who don't want COVID-19 related training (AOR [95% CI]= 1.870[1.105,3.165]). Other variables like age, sex, and level of knowledge were not significantly associated with the level of attitude (Table 8).

Table 8 Factors associated with attitudes towards COVID-19 among Medical students in Addis Ababa, Ethiopia, 2021 (n=349)

Variables		**Level of Attitude**		**P-Value**	**95% CI**		**P-Value**
		Negative	**Positive**		**COR**	**AOR**	
Age in years	18-23	157 (64.6%)	56 (52.8%)	0.039	1	1	0.189
	>23	86 (35.4%)	50 (47.2%)		1.630 (1.026,2.590)	1.383 (0.853,2.245)	
Sex	Male	135 (55.6%)	72 (67.9%)	0.031	0.590 (0.365,0.954)	1.520 (0.924,2.500)	0.099
	Female	108 (44.4%)	34 (32.1%)		1	1	
Wants COVID-19 training	**Yes**	**150 (61.7%)**	**81 (76.4%)**	**0.008**	**2.009 (1.197, 3.371)**	**1.870 (1.105,3.165)**	**0.020***
	No	**93 (38.3%)**	**25 (23.6%)**		**1**	**1**	
Level of Knowledge	Poor	157(64.6%)	60(56.6%)	0.157	1	1	0.505
	Good	86(35.4%)	46(43.4%)		1.400 (0.879,2.229)	0.85 (0.523,1.376)	

5.7 Factors associated with precautionary measures towards COVID-19

With the reference to the factors associated with participants,' precautionary measures towards COVID-19 respondents who were in the Clinical-I stage were 6.5 times more likely to have good practice than those students who are in the Pre-Clinical-I stage (AOR [95% CI] = 6.482[1.360, 30.89]). Once again, those participants with a positive level of attitude towards COVID-19 were 2.8 times more likely to practice good preventive measures towards COVID-19 than those students with a negative level of attitude. Variables like the type of university that the students are studying, age, sex, training status, and level of knowledge were not significantly associated

with the level of preventive measures towards COVID-19 in the multivariable logistic regression (Table 9).

Table 9 Factors associated with precautionary measures towards COVID-19 among Medical students in Addis Ababa, Ethiopia 2021 (n=349).

Variables		Level of Preventive Measures		P-Value	95% CI		P-Value
		Poor	Good		COR	AOR	
University	Governmental	222(74.2%)	31(62.0%)	0.075	0.566 (0.302,1.060)	0.573(0.288,1.143)	0.114
	Private	77(25.8%)	19(38.0%)		1	1	
Educational Status	Pre-Clinical-I	51(17.1%)	2(4.0%)		1	1	
	Pre-Clinical-II	63(21.1%)	11(22.0%)	0.059	4.452 (0.944,21.003)	4.152(0.848,20.332)	0.079
	Clinical-I	**58(19.4%)**	**18(36.0%)**	**0.007**	**7.914(1.751,35.771)**	**6.482 (1.360,30.89)**	**0.019***
	Clinical-II	66(22.1%)	7(14.0%)	0.227	2.705 (0.539,13.576)	2.586 (0.49,13.614)	0.262
	Internship	61(20.4%)	12(24.0%)	0.040	5.016 (1.073,23.457)	4.717 (.896,24.84)	0.067
Age	18-23	187(62.5%)	26(52.0%)	0.159	1	1	0.939
	>23	112(37.5%)	24(48.0%)		1.541 (0.844,2.814)	0.97 (.462,2.044)	
Sex	Male	172(57.5%)	35(70.0%)	0.099	1.723 (0.902,3.290)	1.229(0.599,2.52)	0.574
	Female	127(42.5%)	15(30.0%)		1	1	
Trained for COVID-19	Yes	104(34.8%)	22(44.0%)	0.211	1.473(0.803,2.703)	1.252 (0.652,2.405)	0.499
	No	195(65.2%)	28(56.0%)		1	1	
Level of Knowledge	Poor	192(64.2%)	25(50.0%)	0.057	1	1	0.351
	Good	107(35.8%)	25(50.0%)		1.794 (0.982,3.278)	1.361 (0.712,2.603)	
Level of Attitude	**Negative**	**219(73.2%)**	**24(48.0%)**	**0.000**	**1**	**1**	**0.002***
	Positive	**80(26.8%)**	**26(52.0%)**		**2.966 (1.610,5.464)**	**2.794 (1.465,5.326)**	

6 DISCUSSION

The COVID-19 in Ethiopia is part of the ongoing worldwide pandemic of coronavirus disease 2019 which is caused by SARS-CoV-2. In nature, as the virus is highly contagious and spread throughout the population it requires the maximum number of the health workforce to contain the spread, as well as manage the infected part of the inhabitants. However, Ethiopia is one of the countries yet not fulfilled the minimum requirement of health professionals to a population ratio set by the world health organization (WHO) which directly hinders the management of the cases. Concerning this, different countries involved medical students in the management of the C0VID-19 pandemic (40,41) Consequently, in case if Ethiopia requires involving medical students in the process of COVID-19 management it needs to equip the students with the skills. This study intended to assess Knowledge, Attitude, and Precautionary measures towards COVID-19 among medical students.

After contacting a total number of 371 medical students from Addis Ababa, Ethiopia, 349 students have completed the requirement of participation and were included in this study. Among the participants 207 (59.3%) were males and 142 (40.7%) were females. The mean age was 23.13 years with a standard deviation of 2.61 years.

The result points out that good knowledge of medical students were 37.8% which is far lower compared to similar studies conducted on knowledge, attitude, and precautionary measures towards COVID-19 in Ecuador medical students 88.0% (29) Ugandan medical students 91% (30), in western Ethiopia, Gonder among health care workers 73.8% (31), and the study conducted in Addis Ababa, Ethiopia on community pharmacists, where (53.2%) of the respondents were found with sufficient knowledge about COVID-19 (33). The probable reason for the alteration in the level of knowledge might be due to the study setting, and the difference in the study participants, where this study included participants from pre-clinical stages; whereas studies conducted in similar study settings are through on health professionals that may have training access regarding COVID-19.

In this study, the main information source regarding COVID-19 was social media (the likes of Facebook, and Twitter) 46.4% which is consistent with a similar study conducted in Ethiopia on different study participants, 44.4% (33). To improve the knowledge level of the students it is believed to encourage the students to utilize scientific information sources, and include COVID-19 education in the curriculum. Shreds of evidence from Denmark and Mexico suggested the changes in medical education can improve the response to the COVID-19 management (42).

In the multivariable logistic regression analysis of the present study, the primary factors associated with knowledge were educational status. Those students who are in pre-clinical-II, clinical-I, clinical-II, and students in the internship stage were 2.9, 3.1, 3.4, and 2.9 times more likely to have good knowledge towards COVID-19 than those students in pre-clinical-I respectively. Similarly in a comparable study conducted in Uganda fourth-year medical students had more sufficient knowledge than their first-year counterparts ($P<0.01$) (30), Study conducted in western Ethiopia having good knowledge towards COVID-19 were 2.85 times higher among Health care providers having master degrees [AOR: 2.85; 95% CI (1.25, 6.00)] as compared with health care providers holding diploma (31), and also in the study published from Addis Ababa Ethiopia community pharmacists showed that a good knowledge was higher among pharmacists as compared to pharmacy technicians (AOR: 2.65; CI: 1.50, 4.65). In addition, participants with six to 15 years of service were more likely to have adequate knowledge about COVID-19 as compared to those who served for 5 years or less (AOR: 2.12; CI: 1.18, 3.79) (33). Based on the findings from this study and other similar studies knowledge towards COVID-19 improves with work experience, educational level, clinical stage, and year of practice. As well, in the current study being male were positively associated with good knowledge than female participants with ($P<0.03$).

On the subject of attitudes of the respondents, the positive attitude level was **30.4%,** which is also greatly lower than the positive attitude level in the study conducted in Addis Ababa community pharmacists 54.1% (33), and among Gonder, health care workers found to be 65.7% (31). Conceivably, the dissimilarity between the study population might be the reason for the alteration in the attitude level of the different studies, where the present study was conducted on students, while the others are on health professionals. Of the attitude questions which widely responded negatively were the response on their institution preparedness for the COVID-19 outbreak, and the pandemic controllability in Ethiopia, which are consistent with the previous studies.

Even if the students believed that the hospitals in the country were not well prepared to contain the pandemic, 81.4% of the participants were willing to volunteer at a health facility as frontline health care workers during the COVID-19 outbreak, which is a much better proportion than the study conducted on the same population in Ecuador 57.9% (29). In the present study, 67.6% of the participants were fascinated to deal with COVID-19 suspect cases. This result is promising compared with a study conducted in a similar study setting in northwest Ethiopia, central Gonder health care providers on June 1, 2020, where 88.5% of the participants were not interested to be involved in the treatment of COVID-19 patients (31). The variation might be due to the study period as this study was conducted one year later the start of the pandemic.

Precisely to the attitude of the participants related to preventive measures recommended by WHO to reduce the transmission of COVID-19 was very satisfactory with a positive response proportion of 93.7%. This finding is also similar to that of researches conducted in other areas like North West Gonder Ethiopia health care workers 94.6%, and Addis Ababa community pharmacists 89.8% (33). In the multivariable analysis of this study participants who want COVID-19 related training were 1.87 times more likely to have a positive attitude than those students who don’t want the training with P=<0.02.

Regarding the practice level of the participants of this study, good precautionary measures were significantly altered than other similar studies. Of the participants, only 45% of the respondents experience good preventive measures towards COVID-19. This is also underprivileged compared to other literatures published from Ugandan medical students 57% (30), Iranian medical students 95%, and Shaanxi Province, China showed the proactive precautionary measure in 87.94% of participants (22). The possible variation between the studies may be raised from the negative attitude level of the participants towards COVID-19, where the attitude of the present study population were lower and significantly affected the practice of the study participants.

Conferring to the present study 39% of the participants stated the institutions that currently they are instructing were not implementing the protocol or guideline to control COVID-19 spread, and likewise, 61% of the study population reported that they have no the necessary safeguards and personal protective equipment for the care of COVID-19 patients in their health facility. This finding was satisfactory compared to the result from Ecuadorian medical students where only 9.4% of the participants reported that they have the necessary safeguard to combat the pandemic (29). Another study conducted in Addis Ababa community pharmacists also showed that 70.2% inadequate protective measures were taken to protect the staff from COVID-19 in the institutions of participants, and the major reason described with this was resource scarcity (33). Over all the present and other similar studies results have proved COVID-19 related preventive measures were inadequate in the institutions, which may be related with that most of the COVID-19 protocols and personal protective equipment requires advanced setups and materials to implement the recommend controlling protocols and to have the safeguard against the infection, hence the possible explanation might be the shortage of the infrastructures and pharmaceuticals.

From 349 participants' only 24.9% of participants have had a conference or training on COVID-19 diagnosis, handling of the sample, biosecurity. This proportion is far below the results from Ecuador medical students, which were 50.8% (29), and the deviation might be seen because of the difference in the study setting.

Among the participants regarding their good precautionary behaviors, 71.1% of students' interest in for looking updates on the issue of COVID-19 has grossly reduced, 61.3% are not using alcohol-based sanitizer, and 53.9% of the participants are not using N-95 facemask while entering a room where aerosol-generating procedures performed. These discoveries are much

lower compared to the findings from China (22). The possible reason behind this poor practice from the participants of the present study might be burnout of the condition, and lack of the necessary personal protective equipment, as well as the difference in the study setting with the comparable study from Shaanxi Province.

On the subject of factors associated with the precautionary measure towards COVID-19 educational status and level of positive attitude were significantly associated with the level of preventive measures in the multivariable logistic regression. Medical students in the clinical stage-I were 6.48 times more likely to practice COVID-19 preventive measures than those students in pre-clinical-I, and participants with positive attitude towards COVID-19 practices preventive measures 2.79 times than those students having a negative attitude towards COVID-19 infection.

7 LIMITATIONS AND STRENGTHS OF THE STUDY

This study likewise other KAP surveys has some limitations. Assessment of precautionary measures using questionnaire-based inquiries may not reflect the actual practical level of the participants, and behavioral patterns may be underestimated due to respondents having a desire to mark what they consider to be “socially acceptable” responses. Furthermore, this study was conducted in Addis Ababa medical schools apart from other health science students, and further medical schools in the country.

Despite these limitations, this study is a reliable estimate of knowledge, attitudes, and precautionary measures of Addis Ababa medical students towards COVID-19, and as it is the first in Ethiopia can help to inform their training needs.

8 CONCLUSION AND RECOMMENDATION

8.1 CONCLUSION

In conclusion, this study demonstrated that medical students of Addis Ababa had Lower knowledge, attitude, and precautionary measures towards COVID-19 compared to other studies.. Among the participants, those students in the clinical stage and internship had better knowledge regarding COVID-19 than their counterpart students in the pre-clinical stage. Remarkably, despite being pessimistic about their health facilities' preparedness for the management of the COVID-19 outbreak, the majority of the students were willing to volunteer in the health facility.

8.2 RECOMMENDATION

Grounded on the finding of the present study as a long term solution to improve the knowledge, attitude, and precautionary measures of medical students towards COVID-19 policymakers of medical education shall work on the development, and design of a specific curriculum, and educational materials regarding COVID-19 infection that could act as an essential healthcare resource for the future. Meanwhile, if involving medical students in the management of containing the pandemic is obligatory, as a short-term solution NGOs like the Ethiopian Society of Emergency Professionals (ESEP) shall work on COVID-19 related training in collaboration with the Ethiopian Ministry of health and other concerning bodies.

Solely curriculum development and pieces of training may not improve the KAP status of the students. Hence, all private and governmental medical schools in Addis Ababa shall also invest in encouraging medical students to utilize continued access to online health information resources like free courses, clinical management guidelines, and webinars on COVID-19 offered internationally and nationally may help to equip the medical students.

Furthermore, to sidestep the limitations seen in this study the future researchers shall elude the bias of assessing attitude and practice on paper-based questions by implementing direct observation of practice to get more accurate and actual behavioral pattern estimates. Once more the upcoming studies shall include the missing medical schools in the country and students of other health sciences.

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ANNEXES

CONSENT SHEET

Dear participants, Greetings!

This study is proposed to assess COVID-19 knowledge, attitude, and precautionary measures among medical students in Addis Ababa, Ethiopia. The questionnaire is divided into four parts: Questions related to socio-demographic characteristics, knowledge level, attitude, and precautionary measure towards COVID-19. There is no hurt in participating in this research. Your names and other personal identifies will not be written on the questionnaire. I assure you that all the information you gave will be confidential, and participation in the study is voluntary, as well as you have a full right to participate or not, in the study. However, the findings of this study are believed to contribute to the development of policies, training, and guidelines related to COVID-19. Hence, you are kindly requested to provide a genuine answer to the questions included in the questionnaire below.

If you need any clarification please, do not hesitate to communicate with the facilitator. For further questions regarding the study, feel free to communicate with the principal investigator: (Asegid Mekonnen: +251910897999).

Thank you for your cooperation!!

Are you volunteer to participate in the study?

1) Yes ☐

2) No ☐

Signature_____

Great, you are awarded a pen!!

ASSESSMENT TOOL

Part 1: Socio-demographic characteristics of the participants

	Questions	**Answers/Choices**
1	Name of the university you are currently studying	AAU St.PMMC Yekatit12 MC Africa MC Bethel MC Hayat MC
2	Clinical year	Pre-clinical I Pre-clinical II Clinical I Clinical II Internship
3	Age in years	_____years
4	Sex	Male Female
5	Religion	Orthodox Muslim Protestant Catholic Other (Specify)_____
4	Do you have any chronic diseases?	Yes No
5	Have you attended any training regarding COVID-19?	Yes No
6	Would you like to attend more training related to COVID-19?	Yes No

Part 2: Questions related to knowledge level towards COVID-19

Section 1: General Knowledge

	Statements	**Choices**		
		True	**False**	**Not sure**
1	SARS-CoV-2 (the virus that causes COVID-19) is a new coronavirus identified at the end of 2019, and when it infects humans, causes acute respiratory infection.			
2	SARS-CoV-2 is a positive-sense single-stranded RNA virus.			
3	SARS-CoV-2 is a member of the subgenus Sarbecovirus (beta-CoV B lineage)?			
4	SARS-CoV-2 can live for some time on some surfaces?			
5	Not everyone with COVID-2019 will develop serious cases; rather people who have the following characteristics are more likely to have a serious illness: Age over 65 years, have comorbidities, obese.			
6	Being in contact with your pets would lead to SARS-CoV-2 virus infection?			
7	SARS-CoV-2 stays in the air for 3 hours.			
8	SARS-CoV-2 is transmitted by animals.			

Section 2: Diagnosis and treatment

	Statements	**Choices**		
		True	**False**	**Not Sure**
9	The most prevalent symptoms of COVID-19 are fever, cough, and fatigue.			
10	The main incubation period for COVID-19 is 1-30 days?			
11	The main transmission mechanism of SARS-CoV-2 is close person-to-person contact between people infected with the virus, whether symptomatic or asymptomatic.			
12	The diagnosis for COVID-19 is recommended by the WHO made by a rapid test.			
13	The diagnosis for COVID-19 recommended by the WHO is made by the polymerase chain reaction (RT-PCR) test of the nasopharyngeal swab.			
14	A suspicious case of COVID-19 is defined as any patient who meets the clinical picture of an acute respiratory syndrome (fever,			

	cough, dyspnea, fatigue), and/or epidemiological criteria (being in contact with a suspected or confirmed case of COVID 19, travel or residence in an area with active infections in the last 14 days), but without confirmation by laboratory test.			
15	A confirmed case of COVID-19 is defined as any patient who meets the clinical picture of the acute respiratory syndrome and/or epidemiological criteria confirmed by laboratory testing.			
16	There is currently no effective cure for COVID-2019, but early supportive and symptomatic treatment helps most patients recover from infection.			
17	The use of antiviral drug remdesivir is recommended as a treatment for hospitalized COVID-2019 patients to speed up recovery.			

Section 3: Prevention and prognosis

	Question	**Choices**		
		True	**False**	**Not Sure**
18	Hand hygiene should be performed for more than 20 seconds, mainly handwashing with soap.			
19	The personal protective equipment recommended by the WHO, for the care of a suspected or confirmed case of COVID-19, without aerosol-generating procedures, include hand hygiene, N95 mask, gloves, gown, and protective glasses.			
20	The recommendation of the distance between patients and health personnel as far as possible due to the fact that the micro particles generated by coughs or sneezes spread up to 2 meters away, and therefore are potential virus transporters.			
21	The lifetime of the N9-5 mask is 7 days.			
22	Isolation is an effective way to reduce the spread of the virus.			
23	Patients affected by COVID-19 can recover from the disease.			
24	People who recovered from the disease can still transfer or spread the virus.			
25	One sick person can transmit the disease to about four other people.			

Section 4: Which of the following sources you use to get information about COVID-19?

Information Sources	Never	Rarely/so metimes	All/Most of the time
Social Media (Facebook, Twitter, etc.)			
Google search			
PubMed, up-to-date, and similar sites			
International and local organizations			

Part 3: Questions related to Attitude towards COVID-19

	Questions	Choices	
		Yes	No
1	Would you be willing to volunteer at a health facility during the COVID-19 outbreak?		
2	Do you think that your health facility is prepared for a COVID-19 outbreak?		
3	Do you agree that COVID-19 will be controlled in Ethiopia?		
4	Do you think that you are a potential source of contagion for your family?		
5	Do you agree that following WHO recommendations helps to reduce the transmission of COVID-19?		
6	Do you think health education can help to prevent the disease?		
7	Do you agree that wearing a regular mask prevents getting the disease?		
8	Would you refuse to work with a patient who is a suspect of COVID-19?		
9	Would you consider having a vaccination against COVID-19 if it is available?		
10	Do you think that the number of COVID-19 cases will increase beyond the capacity of our local hospitals?		

Part 4: Questions related use of precautionary measures towards COVID-19.

	Questions	Choices	
		Yes	No
1	Is your health facility following a protocol or guideline to control COVID-19 spread?		
2	Do you have all the necessary safeguards and personal protective equipment for the care of COVID-19 patients delivered by your health facility?		

3	Are you having conferences or talks/training on COVID-19 (diagnosis, handling of samples, and biosecurity) in your health facility?		
4	Is the frequency of looking for information to stay informed about COVID-19 as high as the beginning?		
5	During the outbreak do you have participated in infection prevention and control (IPC); use, putting on, taking off, and disposal of personal protective equipment (PPE)?		
6	During a health care interaction with patients, did you remove and replace your PPE according to the protocol (Eg. When medical mask become wet, dispose of the wet PPE in the waste bin, perform hand hygiene, etc)		
7	Do you apply WHO's "My 5 moments for hand hygiene" (Before touching a patient, before any clean or aseptic procedure, after exposure to body fluids, after touching a patient, and after touching patient surroundings)?		
8	Are you vaccinated for COVID-19?		
9	Are you using alcohol-based hand sanitizer after public transportation or other activities?		
10	Are you wearing N-95 face mask when entering a room where aerosol-generating procedures performed?		