KNOWLEDGE, ATTITUDES, PRACTICES, AND SOCIO-DEMOGRAPHIC DETERMINANTS OF COVID-19 VACCINATION UPTAKE AMONG SECONDARY STUDENTS IN KAJIADO NORTH SUB COUNTY, KENYA

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DECLARATION

Declaration by Candidate:

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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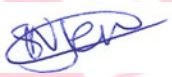
This thesis has been submitted with our approval as university supervisors.

Signature: ... 

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DEDICATION

Dedicated to my husband Enoch Mwita and my three boys, Reagan, Ryan and Robel who were always there for me even when things were tough.

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ABSTRACT

Background: The COVID-19 pandemic has exerted profound impacts on health, society, and the economy in Kenya. In an effort to facilitate the safe reopening and efficient operation of schools, the government initiated a vaccination programmeme within secondary schools. However, despite the programmeme's implementation, the uptake has been less than satisfactory.

General Objective: This study assessed the knowledge, attitudes, and practices (KAP) related to COVID-19 vaccination among secondary school students in Kenya's Kajiado North Sub County.

Methods: A descriptive cross-sectional survey was conducted involving 246 secondary school students from Kajiado North Sub-County, Kenya. The students were selected from a pool of 3 boarding schools and 2-day schools, employing proportionate random sampling. Data were collected through face-to-face interviews using a structured questionnaire and analysed through frequencies and chi-square tests.

Findings: The findings revealed that the 95.3% (n=193) had good knowledge on COVID-19 vaccination; 75.7%(n=153) had positive attitudes towards COVID-19 vaccination; and 95.0% (n=193) practiced proactive measures regarding COVID-19 vaccination. The study identified statistically significant association between age of the student and COVID-19 vaccination (p =0.0086); gender and COVID-19 vaccination (p=0.0040), form levels (p = 0.0189 and p = 0.0355), school category (p=0.0451). This significant negative effect indicates that students in day schools are less likely to get vaccinated compared to those in boarding schools. Finally, religion showed no statistically significant relationship with vaccine uptake (p= 0.7589).

Conclusion and Recommendation: The study's findings reveal relatively good knowledge, positive attitudes and proactive practices towards COVID-19 vaccination. The findings also indicate that COVID-19 vaccination is age and gender dependent. The study recommends the need for targeted interventions and policy adjustments to further enhance vaccine coverage.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

COVID-19: Corona Virus Disease 2019

CPIGH: Center for Policy Impact in Global Health.

GoK: Government of Kenya

HBM: Health Belief Model

HBM: Health Belief Model,

KAP: Knowledge, Attitude and Practice

MERS-CoV: Middle East Respiratory Syndrome Coronavirus.

MOH: Ministry of Health

MOI: Ministry of Interior and Coordination of National Government

NACOSTI: National Commission for Science, Technology and Innovations

SARS-CoV: Severe Acute Respiratory Syndrome Coronavirus

TSC: Teachers Service Commission

UNICEF: United Nations International Children's Emergency Fund

WHO: World Health Organisation

OPERATIONAL DEFINITION OF TERMS

Attitudes: Encompasses the feelings, beliefs, and perceptions that individuals hold towards COVID-19 vaccines (Lee et al., 2022).

COVID-19 Vaccination Uptake: The act of receiving a COVID-19 vaccine dose (Purnama et al., 2023).

COVID-19: A respiratory illness caused by the SARS-CoV-2 virus, first identified in December 2019, and characterized by symptoms such as fever, cough, and difficulty breathing (Wong et al., 2022).

Knowledge: Refers to the information, awareness, and understanding that individuals have regarding COVID-19 vaccines, including their benefits, risks, and the science behind vaccination (Habib et al., 2022).

Pandemic: Disease outbreak that spreads across countries or continents (Qin et al., 2022).

Passive Proactive Practices: Refers to behaviours and actions related to COVID-19 vaccination that are less active or initiated by the secondary students (Radwan et al., 2023).

Practices: The behaviours and actions related to COVID-19 vaccination, such as seeking vaccine-related information, willingness to be vaccinated, promoting vaccination among peers of family members, and the act of getting vaccinated (Sirat et al., 2023).

Proactive Vaccine Practices: Deliberate and forward-thinking behaviours and actions related to COVID-19 vaccination undertaken by the secondary students (Radwan et al., 2023).

Secondary Students: Refers to students enrolled in secondary educational institutions, typically ranging in age from 13 to 18 years (Mudenda et al., 2023).

Socio-demographic Determinants: These include factors such as age, gender, religion and form level that may influence an individual's

knowledge, attitudes, and practices regarding COVID-19 vaccination (Rehati et al., 2022).

Vaccine Hesitancy: The reluctance or refusal to vaccinate despite the availability of vaccination services (Ackah et al., 2022).

CHAPTER 1: INTRODUCTION

1.1 Overview

The chapter introduces the profound impact of COVID-19 on global health and education, with a specific focus on Kenya. It outlines the historical context of infectious diseases, emphasizing the emergence of COVID-19 and its consequences. The chapter discusses the varying responses to the pandemic, including vaccine development and implementation strategies. Special attention is given to Kenya's response in the educational sector, highlighting the challenges and efforts made in vaccinating students in schools. The chapter sets the stage for a detailed exploration of the Knowledge, Attitudes, and Practices (KAP) towards COVID-19 vaccines among students in Kajiado North Sub-County. This introduction establishes the relevance of the study in understanding the implications of these measures on students' health and education, providing a comprehensive background for the subsequent investigation.

1.2 Background

Infectious diseases were the primary cause of the global burden in terms of disability and premature death until the turn of the 21st century. However, infectious diseases have been more effectively controlled and even eradicated in developed countries compared to developing ones, thanks to the availability of effective and affordable antibiotics and vaccines. Nevertheless, over the past two decades, the coronavirus family has rapidly evolved, giving rise to various illnesses, including the common cold, severe acute respiratory syndrome (SARS-CoV), and the Middle East Respiratory Syndrome (MERS-CoV). As noted by Campbell et al. (2021), approximately one-fifth of the world's mortality and morbidity rates can be attributed to infectious diseases.

The emergence of COVID-19, first identified in Wuhan, China in December 2019, ignited an unprecedented global wave of infections (Wong et al., 2020). This disease was officially named "COVID-19 by the World Health Organisation (WHO)" on February 11, 202. This highly contagious virus primarily spreads from human to human, often via aerosols and respiratory droplets. The symptoms of the disease are diverse, with cough, fever, fatigue, myalgia, and sore throat being some of the common manifestations. Unfortunately, in severe cases, it can lead to devastating complications such as cardiac arrest, respiratory failure, pneumonia, and, in extreme cases, death (Dubik et al., 2021).

Following the WHO's declaration of COVID-19 as a global pandemic, various control measures were swiftly implemented worldwide. These measures included restrictions on human movement, remote work and study arrangements, closure of educational institutions, bans on public gatherings, cessation of public transportation, quarantine protocols, social distancing guidelines, mask mandates, regular surface disinfection, and other hygiene practices (Sayed & Mahmoud, 2021). Additionally, special precautions were emphasized to protect vulnerable populations, including healthcare providers, the elderly, and children. However, starting from mid-2021, many countries began to relax some of these stringent measures as a significant portion of the population became vaccinated. This was in line with the WHO's recommendation that vaccination offers a good strategy to control the pandemic. As of March 2, 2022, at least 37 vaccines were in various phases of preclinical development, with only 13 vaccines approved as of December 2021.

Despite the importance of vaccination in controlling the spread of COVID-19, vaccine hesitancy has emerged as a significant barrier to achieving widespread vaccine uptake. Vaccine hesitancy refers to the reluctance or refusal to vaccinate despite the availability

of vaccines. This hesitancy can stem from various factors, including lack of trust in healthcare systems, misinformation, religious beliefs, and concerns about vaccine safety (Kabakama et al., 2022).

Vaccine hesitancy in various regions such as Asia, Europe, the USA, Brazil, and China exhibits unique characteristics, with varying rates influenced by local factors. In Asia, hesitancy rates differ across countries; for example, a study by Wong et al. (2022) found that hesitancy in Japan was approximately 34%, while in India, the hesitancy rate hovered around 23%. These disparities can be attributed to cultural factors, concerns about vaccine side effects, and religious beliefs.

In European countries, the rates of vaccine hesitancy also vary. A survey conducted by the European Commission in 2022 reported that hesitancy in France was among the highest in Europe, with about 32% of respondents expressing reluctance or skepticism toward COVID-19 vaccines. In contrast, countries like Denmark and Portugal reported lower hesitancy rates, at 12% and 10%, respectively (European Commission, 2022).

In the USA, vaccine hesitancy has been a significant barrier to achieving high vaccination rates, with hesitancy levels ranging from 30% to 40%, depending on the region (CDC, 2022). Political polarization, mistrust in government institutions, and misinformation spread through social media have contributed to these high rates. Brazil has experienced a relatively lower rate of vaccine hesitancy, with studies showing hesitancy at around 18% (Silva et al., 2022). However, skepticism toward COVID-19 vaccines in Brazil is influenced by political factors and misinformation.

China, on the other hand, has seen lower levels of vaccine hesitancy, with reports indicating a hesitancy rate of about 10% (Li et al., 2022). This lower rate can be attributed to strict government control over information and a generally positive public

attitude towards vaccinations. Despite these variations, addressing vaccine hesitancy remains a critical challenge in each of different countries, hence the need to examine the knowledge, attitude and practices associated with COVID-19 vaccination.

Vaccine hesitancy in African countries presents a significant challenge to public health efforts aimed at controlling the spread of COVID-19. According to a study published by the African Centers for Disease Control and Prevention (Africa CDC), vaccine acceptance rates vary widely across the continent, with some countries showing high levels of hesitancy (Osuagwu et al., 2023). For example, a survey conducted by the World Health Organization (WHO) in early 2022 found that Nigeria had a vaccine hesitancy rate of about 41%, making it one of the countries with the highest levels of hesitancy in Africa. Similarly, in Ethiopia and South Africa, approximately 34% and 31% of citizens respectively expressed reluctance or outright refusal to receive COVID-19 vaccines, citing reasons such as lack of trust in the healthcare system, concerns about side effects, and misinformation (Ackah et al., 2022).

Ensuring equitable global access to safe and effective COVID-19 vaccines across all age groups is critical to conquering the pandemic. In early 2022, the WHO emphasized the importance of vaccinating all age groups, prompting nations to develop vaccination strategies for those under 18. By 2022, "seven COVID-19 vaccines received either emergency usage authorization or full endorsement for minors under 18 in at least one country. These include Pfiser-BioNTech and Moderna (authorized outside the US) for adolescents aged 12 and up, Pfizer-BioNTech for children aged 5-11, China's Sinovac and Sinopharm for those aged 3-17, India's Covaxin for kids as young as 2, and the Johnson and Johnson vaccine approved for 12 to 18-year-olds" (Alonso et al., 2022).

The WHO advocates for the administration of COVID-19 vaccines to children and adolescents, citing several benefits. These include the reduction of school closures and the full resumption of educational institutions, mitigation of academic and psychological effects caused by interruptions in education, and prevention of intergenerational transmission. However, despite the WHO's recommendations, as of August 2022, COVID-19 vaccines have only been approved for use in children under 18 in 11 African countries (Sam-Agudu et al., 2022).

Evidence from various scholars suggests that MERS-CoV and SARS-CoV infections are less frequent and less severe among teenagers. Nevertheless, the infection rate among adolescents may be underreported or underestimated, primarily because they often exhibit asymptomatic or mild symptoms, receive adequate protection in school and at home, and undergo minimal testing. Adolescents are also more susceptible to engaging in health practices and behaviours that increase the spread of the virus (Dubik et al., 2021; Handebo et al., 2021). Given the vulnerability of adolescents to COVID-19, vaccination has been proposed as the most effective preventive measure against severe illness and death among school-going children (Campbell et al., 2021).

Even amidst the promotion of vaccine for adolescents, vaccine hesitancy among adolescents is a growing concern that can significantly hinder the success of vaccination campaigns. Empirical studies have identified several reasons for vaccine hesitancy in this age group, with misinformation playing a prominent role. Adolescents often rely on social media for information, making them more susceptible to conspiracy theories and inaccurate health advice (Wong et al., 2022). Concerns about vaccine safety and potential side effects also contribute to hesitancy, as adolescents may hear conflicting information from peers, family, or online sources (Talukder et al., 2024). Additionally, peer pressure and a perceived sense of invincibility can lead adolescents to downplay

the risks associated with COVID-19 and question the need for vaccination (Vasli et al., 2024).

This hesitancy ties into broader efforts by the Kenyan government to combat COVID-19 in schools. While vaccination stands as a cornerstone of these efforts, the initial phases of the pandemic saw various other measures being implemented to contain the virus. These included school closures, online classes, and the 'Operation Back-to-School Campaign' led by the Ministry of Education (MoE) in collaboration with other governmental bodies. These measures reflected the urgency of curbing the spread of COVID-19 while also addressing the concerns surrounding vaccine uptake among students (GoK, 2023).

In its 2022 vaccination strategy, the government of Kenya set a goal of vaccinating 100% of the adult population and 50% of teenagers aged between 15-17 years by the end of 2022. To implement this strategy, the Ministry of Health collaborated with the Ministry of Education and county governments to target secondary school students across the country, given that the majority of secondary students fall within the 15-17 age group (MOH, 2022). Despite this campaign, only less than 30% of secondary schools have enrolled in the vaccination campaign. Kajiado county was among the first counties selected in the initial phase of vaccine rollout by the government to vaccinate secondary school students (MOH, 2022). However, the county reported a vaccine uptake of only 21% among the students, with most schools yet to join the campaign. This motivated the need to gain further insights into the knowledge, attitudes, practices, and socio-demographic factors associated with covid-19 vaccine uptake in secondary schools.

1.3 Problem Statement

The worldwide efforts to combat the spread of the Corona Virus Disease-19 pandemic had profound implications on health, society, and the economy. Specifically, the education sector has been significantly affected at all levels, ranging from early childhood education to higher education (Rego et al., 2023). In response to the pandemic, the government of Kenya implemented a series of measures to contain the virus within the education system. These measures included the enforcement of strict lockdown protocols, the adoption of online learning platforms, contact tracing efforts, the promotion of hygienic practices such as frequent handwashing and sanitization, the implementation of social distancing measures, and the closure of educational institutions at all levels (Al-Aghbari et al., 2023). Additionally, the introduction of vaccination programs, once available, was also considered as a preventive measure. These measures collectively aimed to safeguard the health and well-being of students and educators while mitigating the transmission of the virus within educational settings (MOH, 2022).

The COVID-19 vaccination strategy targeting adolescents aged 15–17 years old is being implemented through secondary schools across Kenya. Numerous secondary schools commenced vaccinating students above the age of 15, with a Ministry of Health (MOH) report indicating that approximately 30% of schools conducted vaccinations. Nairobi, Kiambu, Machakos, and Kajiado secondary schools reported vaccination uptake of between 18 and 21 percent, while other counties reported less than 15 percent uptake (Government of Kenya, 2022). Although Kajiado county, reported a 21 percent uptake, the low vaccination uptake in schools shows that factors beyond school-based vaccination determine vaccine uptake (Wamalwa, 2023). Therefore, it was crucial to investigate the Knowledge, Attitudes, and Practices (KAP) of secondary students

towards COVID-19 vaccines, as these factors can directly impact vaccine acceptance and uptake. Extent review also showed that no systematic KAP survey has been conducted in Kenyan schools to document the behaviour and response of students towards COVID-19 vaccination. The study aimed to address this gap by investigating the knowledge, attitudes, practices, and socio-demographic factors associated with covid-19 vaccine uptake in secondary schools.

1.4 General Objective

To investigate the knowledge, attitudes, practices, and socio-demographic determinants affecting COVID-19 vaccination uptake among secondary school students in Kajiado North Sub-County, Kenya.

1.4.1 Specific Objectives

The study objectives were as follows:

1. To determine the Knowledge level of students on COVID-19 vaccination in day and boarding schools in Kajiado North Sub-County.
2. To assess the attitude of students towards COVID-19 vaccines in day and boarding schools in Kajiado North Sub- County.
3. To investigate the practices adopted by students towards COVID-19vaccines in day and boarding schools in Kajiado North Sub- County.
4. To determine the socio-demographic factors associated with vaccine uptake amongst students in day and boarding schools in Kajiado North Sub-County

1.5 Research Questions

The study investigated the following research questions:

i. What is the knowledge level towards COVID-19 vaccination among students in day and boarding schools in Kajiado North Sub- County?
ii. What are the attitudes towards COVID-19 vaccines among students in day and boarding schools in Kajiado North Sub- County?
iii. What are the practices adopted by students towards COVID-19 vaccines in day and boarding schools in Kajiado North Sub-County?
iv. What are the socio-demographic factors associated with vaccine uptake among students in day and boarding schools in Kajiado North Sub-County?

1.6 Research Hypothesis

The study was guided by the following null hypothesis:

i. There is no difference in the level of knowledge about COVID-19 vaccination between students in day schools and boarding schools in Kajiado North Sub-County.
ii. The attitude towards COVID-19 vaccines is the same among students in day schools and boarding schools in Kajiado North Sub-County.
iii. There is no difference in the practices related to COVID-19 vaccination between students in day schools and boarding schools in Kajiado North Sub-County.
iv. Socio-demographic factors do not influence COVID-19 vaccine uptake among students in day and boarding schools in Kajiado North Sub-County.

1.7 Justification of the Study

With the rise in vaccination rates, several nations, both developed and developing, have eased COVID-19 related restrictions. Measures such as mandatory face masks and social distancing have been phased out (Kunyenje et al., 2023). This significant shift in public health policies has been largely enabled by the widespread uptake of COVID-19 vaccines. In Kenya, the Ministry of Health issued a directive on March 11, 2022, outlining a strategy to bolster the vaccination rate among adolescents aged 15–17 years (GoK, 2022). Given the implementation of this approach within secondary schools, it becomes crucial to comprehend the existing knowledge, attitudes, and practices (KAP) and socio-demographic factors towards COVID-19 vaccines uptake in this context.

Recognizing and understanding the KAP within this demographic could significantly facilitate the acceptance and implementation of the ongoing COVID-19 vaccination drive. Furthermore, such insights could help shape future public health interventions targeting students in day or boarding secondary school, thereby enhancing the efficiency of these initiatives. The study contributes to the broader discourse on COVID-19 management and prevention strategies. By investigating the KAP towards vaccines among Kenyan adolescents, the study could potentially aid in bolstering school-based vaccination programs, ultimately helping to curb the pandemic's spread and impact. The study therefore not only fills an essential knowledge gap, but also offers practical implications for public health policies and interventions.

1.8 Significance of the Study

In the face of the post-pandemic recovery phase, the Ministry of Health (MOH) has been collaborating with various organizations and research entities to gather essential information that can guide appropriate response measures. The ministry has initiated

numerous surveys involving the general public, aiming to collect data on Knowledge, Attitudes, and Practices (KAP) related to COVID-19 across different regions. However, a noticeable gap exists within the student population, with limited evidence in this context. This study sought to bridge this gap by generating pertinent data within school environments, potentially informing the design of programs that address deficits in students' KAP, not only toward the COVID-19 vaccine but also toward vaccinations in general.

The Kenyan government's national COVID-19 vaccination strategy targets secondary schools to enhance vaccine uptake among students. The study findings shed light on adolescents' comfort level and receptivity toward vaccination, providing valuable insights that could greatly inform the development of vaccination programs in schools, not just in Kajiado County but in other counties as well. These insights can be applied to ensure that vaccination programs in schools are not only effective but also sensitive to the unique needs and perceptions of students.

The World Health Organization (WHO) 2022 position statement recognizes that much of the existing evidence on COVID-19 vaccination predominantly comes from children in high-income countries. The organization emphasizes the need for more data from low- and middle-income countries. This study, to our knowledge, represented one of the initial efforts to generate such evidence, contributing to a more inclusive and globally representative body of knowledge.

Furthermore, the study's findings go beyond the immediate context of COVID-19. In a post-pandemic world where COVID-19 may no longer pose a significant threat, the insights gained from this study remain valuable. They can guide public health officials and policymakers in the development of vaccination programs in schools for a variety

of diseases. These insights can help create a more informed and proactive approach to promoting vaccine uptake among students, which is crucial for maintaining overall public health in schools and communities. While the specific focus may shift, the importance of understanding students' KAP in vaccination programs endures as a cornerstone of public health planning and preparedness.

1.9 Scope of the Study and Limitation

The study was framed by four central objectives. The first aim was to determine the knowledge level among students regarding COVID-19 vaccine, focusing on both day and boarding schools within Kajiado North Sub-County. The second objective sought to assess the attitudes of students towards COVID-19 vaccines, once again considering both day and boarding educational environments within the same Sub-County. The third objective was to determine the student's practices toward COVID-19 vaccines and fourth objective was to determine the socio-demographic factors associated with vaccine uptake amongst students in day and boarding schools in Kajiado North Sub-County.

The geographic scope of this study was confined to secondary schools located in Kajiado North Sub-County. The choice of location was deliberate and strategic because Kajiado county is one of the counties with highest adoption of COVID-19 vaccination in secondary school. The conceptual scope of the study, on the other hand, revolved around the Health Belief Model (HBM). This theoretical framework guided the entire process of the research, from design to analysis.

A key limitation of this study arose from the use of a cross-sectional study design. This approach involved collecting data at a single point in time to assess the Knowledge, Attitudes, and Practices (KAP) towards COVID-19 vaccines among secondary school

students in Kajiado North Sub-County. The use of this design introduced the limitation that COVID-19 pandemic and related vaccine information have been rapidly evolving. The cross-sectional design was limited in capturing the dynamic nature of students' knowledge, attitudes, and practices as they respond to new information and changing circumstances.

Another limitation encountered during the study was the non-cooperation of two schools, which declined to participate in the research despite having all the necessary approvals. To address the issue of non-cooperation, the researcher opted to select alternative schools with similar characteristics to the non-cooperative schools, ensuring that the study sample remained representative of the target population. These replacement schools were selected based on factors such as school type (day or boarding), student population size, and geographical location within the sub-county. By incorporating these alternative schools into the study, the research team aimed to mitigate the impact of the non-cooperation and maintain the integrity of the study sample. Covid evolved very fast and some of the findings may have been overtaken by time but they will be important in understanding vaccinations in general.

1.10 Assumptions of the Study

The study presumed that the major events and public health messages regarding COVID-19 vaccinations were significant enough to be memorable to students. Additionally, the study assumed that the use of specific time frames and memory aids in the questionnaire helped in minimizing the impact of recall bias. Assumption was also made that any inaccuracies in recall did not systematically bias the results in a way that significantly alters the conclusions drawn from the data.

The study assumed that the secondary school students in Kajiado North Sub- County were aware of COVID-19 vaccines. Firstly, it assumed that the students in both day and boarding schools in Kajiado North Sub-County possess varying levels of knowledge about COVID-19 vaccinations. Secondly, the attitudes towards COVID-19 vaccines among the students were assumed to influence their vaccination practices. Thirdly, it was presumed that the practices related to COVID-19 vaccination were consistent enough across individuals to identify patterns through cross-sectional analysis. Lastly, the study assumed that socio-demographic factors such as age, gender, economic status, and educational background played a significant role in influencing COVID-19 vaccine uptake among students.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The chapter presents a comprehensive literature review exploring various facets of Knowledge, Awareness, Attitude, and Practices (KAP) towards COVID-19 vaccines, particularly among different demographics globally. The review delves into how people's understanding of COVID-19 and its vaccines is influenced by diverse information sources, education levels, and socio-demographic factors. It sheds light on the varying levels of vaccine knowledge across age groups and nationalities, from high awareness in some regions to notable gaps in others. The chapter also examines attitudes towards vaccines, revealing a spectrum ranging from positive acceptance to hesitancy influenced by factors such as misinformation, fear of side effects, and trust in science. Furthermore, it explores the actual practices related to COVID-19 vaccination, including adherence to vaccination protocols. By dissecting these elements, the chapter aims to provide a thorough understanding of the current global perspective on COVID-19 vaccines and identify areas requiring further research and intervention.

2.2 Review of Related Literature

2.2.1 Knowledge and Awareness on Covid-19 Vaccines

In recent studies across Asia, the level of knowledge among students regarding COVID-19 vaccination has been comprehensively explored. A study by Talukder et al. (2024) in Bangladesh found that a significant majority of higher secondary and university students understand the protective benefits of COVID-19 vaccines, including reduced risk of death. Similarly, in Indonesia, Purnama et al. (2023) reported a high awareness (96.2%) of the vaccination program among adolescents, predominantly influenced by

social media. Further assessment by Oka et al. (2022) in Singapore highlighted an informed student population aware of the limitations and side effects of vaccines, as well as their non-genetic altering nature and effectiveness post-two doses.

Additional studies in Indonesia by Mustain (2022) and Efendi et al. (2022) indicate a generally good understanding of COVID-19 vaccination among teenagers, with over half displaying a high level of knowledge and positive attitudes towards vaccination. The relationship between information sources and knowledge about COVID-19 vaccinations has been widely documented across global studies. In Singapore, a high level of vaccine knowledge among the general population was attributed to effective government-led educational initiatives, utilizing diverse media channels for dissemination (Yuen et al., 2022).

Similarly, research from Oman indicated that a significant portion of adults understand the concept of herd immunity as a benefit of widespread vaccine uptake (Al-marshoudi et al., 2021), and Fazel et al. (2021) reported widespread awareness on the health benefits conferred by vaccinations.

Variations in knowledge about more technical aspects of vaccination, such as the required number of doses, have been noted across different regions. For example, Tadese (2021) reported fair knowledge among adolescents in China, contrasting with reports from Vietnam where adolescents showed a lack of knowledge about vaccination (Duong et al., 2022). Comprehensive knowledge about vaccination protocols was also observed among high school students in Saudi Arabia and secondary school students in Italy, with the latter showing a gender disparity in knowledge levels (Alrasheedy et al., 2021; Souli & Dilucca, 2020). Additionally, secondary students in various countries, including Italy and China, displayed a strong understanding of the ongoing pandemic's

severity and the necessity for public health measures such as curfews and lockdowns (Jia et al., 2021; Alrasheedy et al., 2021a).

In examining the awareness and knowledge of COVID-19 vaccination among students in Africa, several studies have identified varying levels of understanding and the key sources of information influencing these perceptions. In Nigeria, a study by Chinawa et al. (2023) reported that a substantial majority (81.2%) of secondary students were aware of the COVID-19 vaccine's availability, primarily through television (85.9%), internet/social media (83.4%), and parents or family (80%). Furthermore, a significant portion of the students (70.0%) recognized vaccination as an effective disease prevention measure, although only a minority (37.0%) were aware that COVID-19 specific vaccines had been developed. Despite high levels of initial awareness, less than half (49.3%) demonstrated a comprehensive understanding of COVID-19 vaccination details.

In Zambia, Mudenda et al. (2023) found that community workers, family, friends, and social media were the principal information sources. It was observed that vaccinated participants exhibited higher knowledge and attitude scores towards the COVID-19 vaccine compared to those who were not vaccinated (66.2% vs 57.8% in knowledge and 76.7% vs 39.4% in attitudes).

Similar trends were observed in Ethiopia, where Alemu et al. (2023) noted that approximately half of the adolescents reported poor knowledge concerning the COVID-19 vaccine. An additional study in Tanzania by Mutalemwa et al. (2024) assessed young individuals' awareness, revealing that only a small fraction (27.59%) had knowledge regarding their contraction status of COVID-19, indicating a gap in understanding personal health status in relation to the virus. Moreover, Assegu et al. (2024) highlighted

that preparatory student in Ethiopia possessed only modest knowledge (44.6%) about the COVID-19 vaccine.

2.2.2 Attitude towards Covid-19 Vaccination

In the investigation of attitudes toward COVID-19 vaccination globally, significant variations have been noted, encompassing both positive and negative sentiments among student populations. Studies have consistently revealed a generally positive disposition among medical and university students toward the vaccine across different countries (Bekele et al., 2020; Souli & Dilucca, 2020). Positive attitudes are predominantly manifested through an expressed willingness to receive the vaccine, as noted in multiple international studies (Alves et al., 2020; Ju et al., 2020; Nwagbara et al., 2021; Shirmohammadi et al., 2021).

In China, the attitudes of publicschool students toward COVID-19 vaccines have been positively influenced by an increased awareness of the virus's risks, with high knowledge about vaccine efficacy significantly enhancing their attitudes (Bai et al., 2021; Cai et al., 2021). Similarly, in Singapore, a favorable perception among the youth surpasses that of the adult population, with an attitude test indicating an overall positive rate of 86.0% among students (Yuen et al., 2022). This optimistic stance is crucial during public health crises, as evidenced by a study among primary school children in China, where a majority displayed confidence in overcoming the pandemic despite fears of infection (Xue et al., 2020).

However, the timing of data collection has been observed to influence attitudes, with studies such as one conducted among secondary students in the United Arab Emirates noting fluctuations in feelings about the COVID-19 vaccine attitudes, aligning with increases in (Baniyas et al., 2021). Comparative analyses across student demographics

show that students in public schools tend to exhibit lower positive attitudes compared to students in private schools who hold positive attitude (Sayed & Mahmoud, 2021; Sondakh et al., 2022).

A survey conducted online among Hong Kong adolescents demonstrated that those perceiving the COVID-19 situation as severe or knowing someone diagnosed with the virus were more likely to exhibit a positive attitude towards vaccine acceptance (Wong et al., 2022). Similarly, in China, adolescents perceiving higher risks from COVID-19 were inclined to view the vaccine more favorably (Cai et al., 2021). Parental influence also plays a significant role, as demonstrated in China where adolescents with vaccinated parents showed more positive attitudes towards COVID-19 vaccines (Wong et al., 2022).

In Indonesia, an enhanced understanding of COVID-19 and awareness of potential vaccine side effects were associated with more positive attitudes among adolescents (Efendi et al., 2022). This indicates that education and informed awareness are pivotal in shaping positive perceptions towards vaccinations. Furthermore, a comparative study by Sondakh et al. (2022) revealed that senior high school students in Indonesia displayed better attitudes towards vaccines compared to their junior high school counterparts, suggesting that age and educational level may influence vaccine attitudes.

In Jordan, attitudes towards vaccines among students also varied significantly between medical and non-medical fields, with medical students exhibiting more positive attitudes compared to non-medical students (Mustafa et al., 2020). A similar distinction was found in China, where attitudes towards COVID-19 vaccines differed notably between medical and non-medical undergraduate student groups, emphasizing the

impact of specific educational backgrounds on vaccine perceptions (Lathifatunnisa et al., 2022).

In the literature examining global student attitudes towards COVID-19 vaccination, varied perspectives have been observed, shaped significantly by regional and cultural factors. A study by Talukder et al. (2024) in Bangladesh assessed attitudes among higher secondary and university students, revealing a positive attitude towards COVID-19 vaccination in 68% of respondents. Similarly, Cai et al. (2021) reported that about 60% of Chinese adolescents were inclined to accept COVID-19 vaccination. In South Korea, a nationwide survey indicated a relatively high acceptance rate among adolescents, with 69.1% favouring vaccination.

Contrastingly, in Switzerland, a more cautious stance was detected by Leos-Toro et al. (2021), where less than half of the students surveyed (46.9%) expressed a likelihood of getting vaccinated upon availability. This cautious approach aligns with findings from a study by Verger et al. (2024) in Africa, where fewer than 50% of adolescents demonstrated favourable attitudes towards COVID-19 vaccines.

In India, a more encouraging perspective was found in an exploratory study by Bhowmick et al. (2022), which highlighted that 74.6% of adolescents aged 15-17 years possessed a good attitude towards COVID-19 vaccination. This positive sentiment was somewhat echoed in Indonesia, where Mustain (2022) and Efendi et al. (2022) found a supportive attitude in 68.1% and positive attitudes in 54.6% of teenagers, respectively. In Italy, a national cross-sectional study by Cupertino et al. (2022) discovered that students aged 10–17 years preferred to receive information about COVID-19 vaccination primarily from their family doctor (51.8%) and at school (28.9%), suggesting that trusted sources play a crucial role in shaping students' attitudes.

Across diverse settings outside Africa, studies on student attitudes towards COVID-19 vaccines show both optimistic and cautious perspectives, with cultural and regional factors influencing these views significantly. In Ethiopia, negative attitudes towards COVID-19 vaccines were reported among secondary students (Shitu & Mose, 2021), with 38.3% of adolescents displaying an unfavourable attitude (Alemu et al., 2023). This suggests a critical need for targeted educational interventions to improve vaccine perceptions among young populations in the region.

Conversely, in Ghana, a positive attitude towards COVID-19 vaccines was observed among students, who perceived the vaccines as protective against the disease (Dubik et al., 2021). This positive view is mirrored in Nigeria, where university students demonstrated favourable perspectives towards COVID-19 vaccinations, with findings suggesting that greater knowledge about the vaccines correlates strongly with more positive attitudes (Nwagbara et al., 2021).

2.2.3 Practices towards Covid-19 Vaccines

The practices of students regarding COVID-19 vaccination vary significantly across different global contexts, reflecting diverse attitudes towards vaccine acceptance and hesitancy. In high-income countries such as the USA, common practices related to COVID-19 vaccination among students are characterized by varying degrees of vaccine acceptance and hesitancy. It was reported by Campbell et al. (2021) that a key practice among U.S. students is their willingness to undergo the vaccination process, indicating a general openness to accepting COVID-19 vaccines.

In Singapore, practices surrounding COVID-19 vaccination were explored in a Knowledge, Attitudes, and Practices (KAP) study by Abbasi et al. (2021), where it was found that a strong belief in the importance of vaccination motivates individuals to take

booster shots as required. Fear of needles was not deemed a significant deterrent. Moreover, a prevalent belief was observed that vaccines should be administered initially to health workers, then to students, before being made available to the general population, suggesting a prioritized approach to vaccination.

Conversely, in Kazakhstan, adherence to the proposed vaccination regimen was widely practiced, as shown by Issanov et al. (2021), with the majority expressing readiness to finance a COVID-19 vaccine. However, willingness to participate in vaccine trials was less common, with less than a third of the population displaying readiness to engage in such studies. Interest in advocating for vaccination within social circles was similarly low, indicating a degree of reluctance to promote vaccination actively. In Bangladesh, a study by Islam et al. (2021) indicated a significant level of vaccine hesitancy, with most of the students not willing to follow COVID-19 vaccine protocol. This hesitancy was primarily driven by concerns over vaccine safety, highlighting the impact of perceived risks on vaccination practices.

In India, a study by Bhowmick et al. (2022) assessed practices among school-going adolescents aged 15-17 years, where more than half of the adolescents (58.0%) reported good practices related to COVID-19 appropriate behavior (CAB), indicating a proactive stance towards vaccination and pandemic-related health measures. However, a smaller percentage (39.6%) exhibited average practice, and only 2.3% displayed poor CAB practices.

Similarly, Kibi et al. (2023) explored the vaccination behavior among youths, finding that the majority expressed a willingness to receive the COVID-19 vaccine, but only after healthcare workers and vulnerable populations had been vaccinated. This reflects a socially responsible attitude towards vaccine distribution priorities.

In the Netherlands, a study by Euser et al. (2022) revealed that the majority of students were inclined to get vaccinated if offered, though 20% expressed reluctance. This suggests a predominant but not universal acceptance of vaccination among students. In Canada, the behaviors of older adolescents towards COVID-19 vaccination were examined, highlighting varied responses to vaccine availability and willingness. According to Rehati et al. (2022), a considerable portion of the population (31.6%) was hesitant, and a smaller fraction (8.4%) was resistant to receiving the vaccine. This hesitancy and resistance reflect underlying concerns that may influence vaccination practices.

Afifi et al. (2021) further analyzed factors affecting the willingness to receive a COVID-19 vaccine among students. It was found that 65.4% of respondents were willing to be vaccinated if it were available, while 8.5% were not, and 26.1% remained unsure. Crucially, willingness did not vary significantly with sex, age, or mental health conditions but was influenced by parental education, household income, financial burdens due to the pandemic, self-reported COVID-19 knowledge, social/physical distancing practices, and physical health conditions.

The prevalence and determinants of COVID-19 vaccine hesitancy among adolescents in Sub-Saharan Africa were highlighted through a multi-country survey conducted by Wang et al. (2022). It was reported that over 80% of adolescents demonstrated proactive practices towards the COVID-19 vaccine. However, awareness levels varied, with 74% and 55% of the adolescents having heard of the vaccines, respectively. In Ethiopia, an empirical study involving preparatory students revealed a markedly lower level of positive behavior towards COVID-19 vaccination, with only 17.5% of students showing positive behavior (Assegu et al., 2024). This suggests significant vaccine

hesitancy among this group, underscoring the need for targeted health education interventions.

In Nigeria, a study by Nwagbara et al. (2021) demonstrated a high rate of adherence to COVID-19 vaccination protocols among university students, with most students following the vaccination guidelines strictly. This adherence indicates a satisfactory level of vaccine-related practices within the student demographic, suggesting a strong compliance with public health directives.

Similarly, in South Africa, a study by Sengupta et al. (2022) explored the relationship between vaccine uptake intentions and COVID-19 safety practices among adults. It was found that the intention to receive a vaccine not only aligned with but also reflected adherence to correct COVID-19 safety practices. Furthermore, a significant correlation was identified between the intention to get vaccinated against COVID-19 and the level of knowledge about the pandemic.

2.2.4 Socio-Demographic Factors Influencing Covid-19 Vaccine Uptake

In the study of socio-demographic factors influencing vaccination uptake among students globally, various findings have been reported that highlight the complex interplay of different factors. In India, a study by Jain et al. (2021) was conducted among college students to assess the acceptance of the COVID-19 vaccine. It was revealed that age, gender, and level of education were not significantly correlated with vaccine acceptance. However, apprehension regarding potential side effects was identified as a limiting factor for vaccination uptake among these students.

In Singapore, the investigation of socio-demographic factors affecting vaccine uptake among adults was carried out by Wong et al. (2022). The employment status was found to be a significant factor, with unemployed individuals or homemakers showing a lower

propensity for vaccination compared to their employed counterparts or those whose jobs were impacted by the COVID-19 crisis. No significant association with vaccine uptake was found for religion, age, or gender in this study.

Conversely, in Europe, Patelarou et al. (2021) focused on high school students and identified sex as a significant factor influencing vaccine uptake. Men were more likely to accept vaccination compared to women, who were more inclined to believe in conspiracy theories leading to vaccine rejection. This finding contrasts with a study in the Czech Republic, where Riad et al. (2021) found that women were more likely to be vaccinated against COVID-19 compared to men. In the United States, Gray & Fisher (2022) conducted research among adolescents aged 12–17 years, reporting that race/ethnicity, parental age, vaccine status, employer vaccination requirements, and the vaccination status of other adults in the household are critical social determinants influencing vaccine uptake.

In Bangladesh, Talukder et al. (2024) assessed factors influencing COVID-19 vaccination acceptance among higher secondary and university students. The study revealed significant relationships between vaccination status and various factors, including gender, education, willingness, encouragement, and belief. It was found that female students were 78% less likely to be vaccinated compared to male students. Furthermore, a higher education level, such as a master's degree, was associated with an increased intention to receive the COVID-19 vaccine, suggesting that better education contributes to greater awareness of COVID-19 effects and preventive measures.

Similarly, in Indonesia, a study by Purnama et al. (2023) identified economic status, the influence of social media information, and awareness of the vaccination program as

significant factors affecting COVID-19 vaccine acceptance. This highlights the role of socio-economic conditions and information dissemination channels in shaping vaccination attitudes and behaviors.

The systematic review by Dhamayanti et al. (2024) sheds light on various socio-demographic factors influencing COVID-19 vaccine hesitancy among adolescents. Gender emerged as a significant determinant, with adolescent females exhibiting greater reluctance to receive the COVID-19 vaccine compared to males. Additionally, the vaccination status of parents played a pivotal role, with adolescents more likely to uptake the vaccine if their parents had already received it. Moreover, adolescents with strong religious affiliations showed a positive association with COVID-19 vaccine uptake, suggesting the influence of cultural and belief systems on vaccination decisions.

Family and community factors also emerged as key determinants of vaccine perceptions among adolescents, as highlighted by a qualitative study across multiple countries conducted by Ramaiya et al. (2024). The vaccination status of family and community members, past vaccine experiences within the family or community, and instances of re-infection among family or community member's post-vaccination were all identified as factors influencing vaccine perceptions.

In Nigeria, Chinawa et al. (2023) explored the willingness to receive the COVID-19 vaccine among secondary students. It was found that male respondents were 1.6 times more likely to accept vaccination compared to females. Additionally, those who recognized their own risk of contracting COVID-19, or knew someone who was infected, were significantly more likely to be willing to vaccinate. Specifically, awareness of potential infection increased the likelihood of accepting vaccination by twice, and knowing someone infected did so by nearly the same factor. Furthermore,

respondents with good knowledge of COVID-19 vaccination were 2.2 times more likely to accept vaccination compared to those with poor knowledge.

In Ghana, Adjaottor et al. (2022) identified gender differences in vaccine hesitancy among adolescents. The study indicated that females had significantly higher scores both in believing COVID-19 information and in COVID-19 vaccination acceptance compared to males. This suggests a greater receptiveness to vaccination among female adolescents when they are well-informed about the virus. Conversely, in Uganda, a study by Logie et al. (2023) on urban refugee youth in Kampala found that vaccine acceptance was notably low, with only 18.1% of participants indicating a high likelihood of accepting an effective COVID-19 vaccine.

In Ethiopia, a multivariable analysis by Alemu et al. (2023) highlighted several factors statistically associated with COVID-19 vaccine hesitancy among students. Notably, sex, educational level, sources of information, knowledge about COVID-19, and attitudes towards the COVID-19 vaccine each showed a significant relationship with hesitancy levels.

Additionally, another study in Ethiopia by Assegu et al. (2024) among preparatory students found that religion, the place of residence, and parents' educational level were associated with students' knowledge about vaccination against COVID-19. Moreover, previous COVID-19 illness and the students' knowledge level were linked to their vaccination practices. This indicates that personal experience with the disease and a higher level of informed awareness can influence positive vaccination behaviors.

In South Africa, Bergh et al. (2023) conducted a study among adolescent girls that identified fear of injections as a significant barrier to vaccine uptake. Conversely,

having been tested for COVID-19 and holding the belief that the vaccine is safe and can prevent severe illness were identified as facilitators of vaccine acceptance.

Further insights from Kenya were provided by Osur et al. (2022), who assessed vaccine behavior intentions and their determinants among the youth. The study found that a cautious approach prevailed, with 52.0% of youths indicating they would wait to see the effects of the vaccine on others before deciding to get vaccinated themselves. Meanwhile, 42.0% expressed a readiness to be among the first to receive the vaccine, whereas a small minority (6.0%) stated they would refuse the vaccine altogether.

Disaggregation by educational level revealed a significant relationship between the level of education and vaccine uptake, indicating that higher educational levels might be associated with greater acceptance of the vaccine. Gender differences were also notable; 60.9% of females preferred to wait and observe the vaccine's effects on others, compared to 47.4% of males who were more inclined to be early recipients. A moderate association between gender and vaccine uptake was statistically significant. Additionally, a significant association between religion and vaccine uptake was identified, suggesting that cultural and religious beliefs are important determinants of vaccine acceptance.

2.3 Theoretical Framework

The theoretical backbone of the study is provided by the Health Belief Model (HBM), a framework developed by Strecher et al. (1997). The Health Belief Model (HBM) is a widely utilized theoretical framework in the field of public health that aims to explain and predict health-related behaviors, particularly in the context of disease prevention and health promotion (Janz & Becker, 1984). The model comprises six primary constructs of perceived benefits, perceived barriers, perceived susceptibility, perceived

severity, cues to action, self-efficacy, and modifying variables. These constructs provide a lens through which individuals' engagement with health behaviors can be understood and influenced (Green et al., 2020).

The constructs of perceived benefits and perceived barriers serve as the core decision-making elements within the HBM. Perceived benefits refer to an individual's assessment of the value or efficacy of engaging in a health-promoting behavior to decrease the risk of disease. In contrast, perceived barriers encompass the potential negative aspects or costs associated with a particular health action(Champion & Skinner, 2008). For instance, in the context of COVID-vaccination, perceived benefits might include protection against the disease, while perceived barriers could involve concerns about side effects in the study.

The study applied perceived benefits and barriers in understanding the student attitudes towards COVID-19 vaccination uptake. The attitude of students towards vaccines can be seen as a balance between what they perceive as the benefits of getting vaccinated (e.g., protection against COVID-19, contributing to herd immunity) versus any perceived barriers (e.g., concerns about side effects) (Alagili & Bamashmous, 2021). Positive attitudes are likely when the perceived benefits outweigh the barriers, prompting a favourable disposition towards vaccination.

According to Karimy et al. (2021), perceived susceptibility and perceived severity address an individual’s evaluation of their risk of contracting a disease and the potential seriousness of contracting this disease, respectively. Perceived susceptibility is a person’s subjective perception of the risk of acquiring an illness, while perceived severity is concerned with feelings on the seriousness of contracting an illness and its potential consequences on one's life (Abraham & Sheeran, 2015). These perceptions

can significantly motivate individuals towards behaviours that are perceived to thwart the onset of disease. For example, a higher perceived risk and severity of COVID-19 are likely to influence individuals to adhere more strictly to recommended vaccination schedules (Mahindarathne, 2021).

Under the HBM, the component of severity and susceptibility was directly useful in determining the knowledge level of students on COVID-19 vaccination. The theory asserts that if students are well-informed about the risks associated with COVID-19 and the protective benefits of vaccines, they are more likely to perceive the disease as a serious threat, thereby increasing their likelihood of getting vaccinated. Knowledge empowers students by shaping their perceptions of susceptibility and severity. These were crucial predictors of whether students considered the vaccination in the current study.

Cues to action are the triggers required to turn motivation into actual proactive behaviour. These cues can be internal, such as physical symptoms, or external, such as media campaigns, advice from others, or illness of a relative (Skinner, Tiro, & Champion, 2015). These cues prompt an individual to act and are crucial in the timing of health behaviours. For vaccinations, cues to action might include reminders from healthcare providers, educational materials distributed at schools, or seeing peers participating in vaccination programs.

Self-efficacy, added later by Bandura (1977) to the original HBM is another component that was important to the current study. Self-efficacy refers to the confidence an individual has in their ability to successfully perform a behaviour. This construct is vital because even if individuals recognize the severity of a health threat and acknowledge the benefits of action, they must also feel capable of performing the actions effectively

(Souli & Dilucca, 2020). In terms of vaccination, this might involve believing in one's ability to schedule and follow COVID-19 vaccination protocol or to overcome fears related to the vaccine.

Practices towards vaccines are influenced by specific triggers or cues, such as informational campaigns or school-based vaccination programs, which remind or encourage students to get vaccinated. Additionally, self-efficacy, or the confidence in one's ability to successfully to get vaccinated, plays a crucial role (Handebo et al., 2021; Zheng et al., 2021). Students are more likely to engage in the recommended health behaviour if they feel capable of successfully navigating the process of vaccination. This aspect was critical in analysing the student practices towards COVID-19 vaccination during the study.

The last component of the model is modifying variables, which include demographic, psychological, and situational factors that can affect perceptions and thereby influence health-related behaviours. These variables can alter the impact of the HBM constructs on decision-making processes (Vasli et al., 2024). For example, age, sex, education, past health experiences, and cultural beliefs can influence perceived barriers, benefits, susceptibility, and severity. Hence modifying factors was applied in analyzing the socio-demographic factors that influence the vaccine uptake among secondary school students.

2.4 Conceptual Framework

A conceptual framework is useful for understanding students' knowledge, attitudes, practices and socio demographic factors influencing COVID-19 vaccination. The conceptual framework in figure 1, explains how KAP is used to assess students' behavior towards Covid- 19 vaccine.

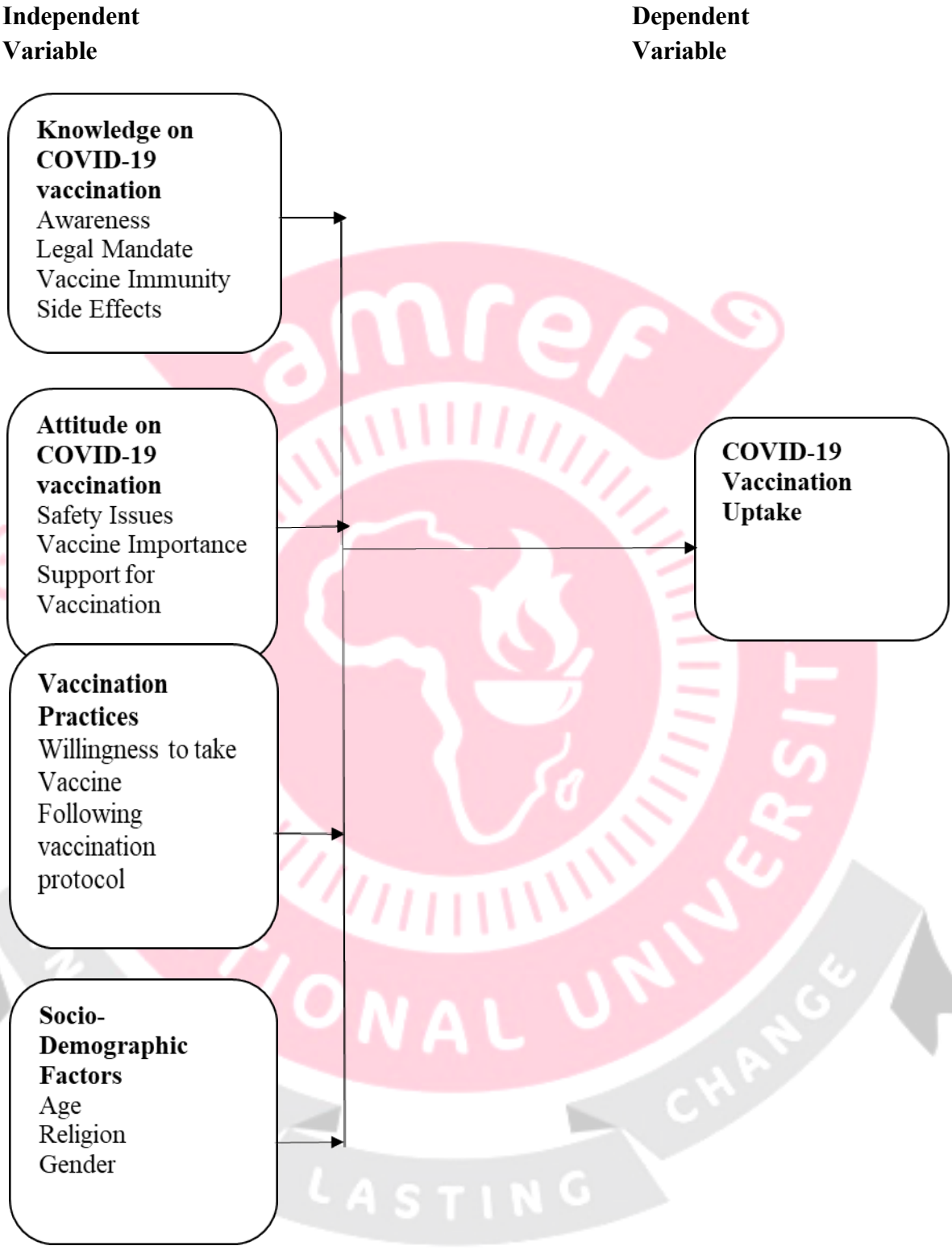

Figure 2. 1:Conceptual framework

(Source: Author's conceptualization).

2.5 Knowledge Gap

COVID-19 pandemic led to various KAP studies globally and regionally. Reviewed studies suggested that while awareness of COVID-19 vaccines was moderate to relatively high among students, the depth of knowledge and understanding of vaccination specifics was still lacking. Reviewed literature also indicated that the existing studies on knowledge of students or adolescent have largely focused on general populace with understanding how KAP disaggregates through institutional, group or individual characteristics.

Reviewed evidence showed that most of the existing studies have focused on adolescents in general as opposed to school going students, with the studies reporting attitudes towards COVID-19 vaccine ranging from unfavorable to favorable. However, there was a need for understanding how attitudes disaggregated based on student characteristics. Literature reviewed on practices of students towards COVID-19 vaccination revealed that the predominant focus of most of the existing studies was on willingness to accept vaccination while ignoring other school-based practices that students were required to observe. This study addressed this gap. Vaccine uptake is influenced by various individual socio-demographic characteristics. Important as these studies are, existing studies fail to include specific school related factors that influence vaccination uptake. This study aimed to fill this gap.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter provides a comprehensive overview of the methods employed in the study. This involves elaborating the study design, geographical setting, population of the study, a description of criteria used to include and exclude participants, participants from who data was collected, research instrument validity and reliability process, data analysis plan and address the ethics considered in the study.

3.2 Study Design

The study was a cross-sectional descriptive study. A cross-sectional descriptive study design was appropriate for evaluating the knowledge, attitudes, practices, and socio-demographic determinants of COVID-19 vaccination uptake among secondary students in Kajiado North Sub-County due to its ability to efficiently capture a snapshot of multiple variables at a single point in time. This design facilitated a broad and immediate assessment across a diverse student population, allowing for the rapid collection of data within a limited time and cost. Moreover, it also enabled the analysis of correlations between vaccination practices and socio-demographic factors without the logistical complexities and time requirements of longitudinal studies. In the cross-sectional approach, data was collected at a single point in time in January to March 2023, 8 months after vaccination campaign had begun in secondary schools. The study spanned a two-month period because the Kajiado County Education Office mandated that data collection in schools could only be conducted with parental consent due to the sensitive nature of the COVID-19 vaccination issue.

Given that the study was conducted approximately 7 months after school vaccination campaign had been rolled out, the design was crucial for understanding how past

experiences and information exposure influenced current knowledge, attitudes and practices among the student population. The data gathered provided a snapshot of the prevailing situation at the time of study while also offering a lens to view the progression of students' responses to COVID-19 vaccination campaigns. Given that the study was conducted 7 months after the start of COVID-19 vaccination campaign in schools, the use of cross-sectional design was not without limitation on the issue of recall bias.

To mitigate the potential effects of recall bias in our study, several strategies were implemented. Firstly, the questionnaire was designed with specific temporal cues to assist participants in accurately recalling their past experiences related to COVID-19 vaccination. Memory aids such as a timeline of vaccination campaign in schools and public health announcements relevant to COVID-19 were provided during the survey to enhance accurate recall. The students were also provided with clear instructions about the importance of accurate recall and were encouraged to give their best estimates rather than guessing if they do not remember clearly. These combined approaches helped to minimize the impact of memory lapse on the validity of the collected data.

3.3 Study Site

The research took place in Kajiado North Sub-County, the largest of Kajiado County's sub-counties and home to a significant number of educational institutions. Kajiado County, one of Kenya's 47 counties, benefits from its location within the Nairobi Metropolis, which includes Nairobi, Kiambu, Machakos, and Kajiado counties. In 2018, the county's estimated population was around 1,112,823, with males and females almost equally represented (50.2 percent males and 49.8 percent females). Kajiado

County is known for its diversity and cosmopolitan atmosphere, with major urban areas that attract a wide range of ethnic groups from all over Kenya (Kajiado County, 2018).

The county has a total of 121 secondary schools, with 70 publics and 51 private schools. Out of these, Kajiado North Sub-County has 34 publics and 16 private schools. Among the 50 schools, 22 are day schools and 28 are boarding schools. The study was conducted in four boarding schools and three-day schools, specifically Najile Boys Secondary School, Oloolaiser High School, Enoomatasiani Girls Secondary School, Lewisa Academy Secondary School, Baraka Oontoyie Secondary School, Maasai Academy, and Star High School. However, due to challenges in obtaining permission at some of the selected schools, data collection was ultimately completed in only five schools: Oloolaiser High School, Enoomatasiani Girls Secondary School, Lewisa Academy Secondary School, Baraka Oontoyie Secondary School, and Maasai Academy. Kajiado County was chosen for the study based on the following reasons:

Early implementation of student vaccination programs was a key criterion in selecting the county. Kajiado County's role as a pioneer in implementing student vaccination programs in collaboration with the national government offered a unique opportunity to study the initial KAP towards vaccination initiatives amongst the pioneer secondary schools in the country.

Figure 3. 1: Kajiado North Sub-County Map

3.4 Study Population

The target population for the study consisted of students in secondary schools in Kajiado North Sub-County, including both day and boarding schools. The study population comprised male and female students. The study was conducted over a two-month period when the students were in school. The inclusion of both day and boarding schools was justified for several reasons. First, it allowed for a more comprehensive understanding of the Knowledge, Attitudes, and Practices (KAP) towards COVID-19 vaccination among secondary students in Kajiado North Sub-County. Day and boarding schools typically have different environments, routines, and student demographics,

which can influence students' KAP. Second, examining both types of schools helped identify whether there were differences in vaccine uptake, KAP, or barriers to vaccination between these two settings. Lastly, incorporating both day and boarding schools ensured a more representative sample of the broader student population, enhancing the generalizability of the study findings.

3.5. Inclusion and Exclusion Criteria

3.5.1 Inclusion Criteria

Participants who were eligible:

i. Must not have received the COVID-19 vaccine prior to the initiation of the school vaccination campaign, allowing the study to assess baseline attitudes and knowledge about the vaccine.
ii. Must have been attending the participating school for at least one full term prior to the commencement of the study to ensure familiarity with the school environment and relevant experiences.

3.5.2. Exclusion Criteria

The exclusion criteria were:

i. Students with health conditions that preclude vaccination, as their inability to receive a vaccine could skew perceptions and attitudes in the study results.

3.6 Sample and Sampling Procedures

3.6.1 Sample Size Determination

To determine the sample size for this study, the researcher employed Fisher's formula (Dupont & Plummer Jr, 1990): $n = (Z^2pq)/d^2$. This formula considers various factors

including the desired sample size (n), the standard normal deviate at a 95% confidence interval (Z) which corresponds to 1.96, and the proportion (P) representing the expected percentage of the target population that have taken COVID-19 vaccine. Based on a previous study conducted among youths in Nairobi County, it was found that only 21% of the students in Kajiado county have taken COVID-19 vaccine. Hence, this estimated percentage was utilized in the calculations. By employing Fisher's formula and considering the proportion of the population expected to possess adequate knowledge, the appropriate sample size for the study was determined.

Therefore, in the formula $n = (Z^2pq)/d^2$, where q=1-p, d= alpha .05, p= 0.21%

Then; sample size (n) = $(1.96^2 \times p \times (1-p)) / .05^2$; which is n =255. Thus, the sample was 255 students.

To accommodate potential attrition, a commonly used method is to increase the sample size by a percentage based on expected dropout rates. According to Aklil and Temesgan, (2022) study conducted on vaccine acceptance among secondary students in Ethiopia, an attrition rate of 5% was deemed appropriate for the cross-sectional study in school settings. The study proposed lower attrition percentage for COVID studies in schools because of low attrition level. Assuming an estimated attrition rate of 5%, the adjusted sample size was calculated based on the formula;

if d is the dropout rate, then adjusted sample size n1 is obtained as $n1 = n/(1-d)$.

After adjusting for an estimated attrition rate of 5%, the revised sample size for the study should was 267 students.

Sampling size divided according to the school population as shown in the table below:

Table 1: Sampling Distribution for the Selected Schools

School	Population	Sampling
Oloolaiser High Sch	2456	110
Enoomatasiani Girls Sec Sch	896	40
Lewisa Academy Secondary School	654	29
Baraka Oontoyie Secondary School	1178	54
Maasai Academy	789	34
Total	**5973**	**267**

3.6.2 Sampling Technique

The study utilized probability and non-probability sampling methods to ensure a representative and relevant selection of schools and participants in Kajiado North Sub-County.

3.6.2.1 School Selection.

The researchers purposively selected 4 boarding and 3-day schools' junior secondary schools in Kajiado North Sub-County. Non-probability sampling techniques were chosen due to the specific requirement that participating schools must have been involved in the COVID-19 vaccination campaign and also the schools must be easily

accessible during data collection. This was done based on information provided by Kajiado North Education office.

The use of purposive sampling played a central role in selecting schools in Kajiado North Sub-County, because schools were chosen based on specific criteria to meet the research objectives. Purposive sampling was instrumental in allowing the selection of schools that had been actively involved in the COVID-19 vaccination campaign, ensuring that the study participants had relevant exposure to the subject matter. The use of purposive sampling also helped to strengthen the representation of students by selecting a mix of boarding and day schools. This diversity ensured that the sample encompassed a broader range of student experiences and social dynamics. This provided a more holistic view of the sub-county's educational landscape.

3.6.2.2 Student Sampling

Within the selected schools, a two-stage sampling process was used:

Proportionate Sampling

To ensure that each school and each educational level (Form One through Form Four) was adequately represented, proportionate sampling was applied. This method calculated the number of students to be included from each form based on the total population of students in each form at the school, ensuring equity and representation across different age groups.

Random Sampling with Replacement

Following the establishment of a sampling frame provided by the school administrations for each form, a simple random sampling technique with replacement was implemented. This approach was utilized to select individual students within each form. The random selection was facilitated through a lottery system, ensuring that every

student had an equal chance of being selected. Importantly, this phase included only those students who had parental consent to participate, aligning with ethical research practices.

3.7 Data Collection Instruments

In this study, we utilized a structured questionnaire, initially inspired by a similar research tool used in a study among secondary school students in Ghana. The original Ghanaian study validated their questionnaire through a multi-step process that entailed designing original questionnaire to be culturally relevant to Ghanaian students, considering local customs, language, and educational environments; consultation with local experts in education, health, and sociology to ensure the questionnaire content was appropriate and through conducting a pilot test with a small group of students from the intended study population, with the study revealing a Cronbach alpha of 0.79. We adapted and modified this questionnaire to better suit our research context in Kajiado North Sub-County, ensuring it was comprehensive and relevant. The questionnaire included sections on socio-demographic factors, which, along with knowledge about COVID-19 vaccines, attitudes towards the vaccine, and practices related to vaccine uptake, were identified as the independent variables. The primary dependent variable in our study was the vaccination status of the students.

The questionnaire was carefully designed to capture a wide range of information. For socio-demographic data, questions addressed age, gender, and educational level, among other relevant factors. The sections concerning knowledge, attitudes, and practices regarding the COVID-19 vaccine included items that were evaluated using a 5-point Likert scale that ranged from Strongly Disagree = 1, Disagree= 2, Neutral = 3, Agree = 4 and Strongly Agree = 5. This scale allowed participants to express a nuanced range

of agreement or disagreement with the statements presented, facilitating a detailed analysis of their perspectives and behaviors towards COVID-19 vaccination. By leveraging the structure and insights from the Ghanaian study and tailoring it to the local context, the questionnaire served as a crucial tool in collecting detailed and context-specific data, which was instrumental in analyzing the relationships between the independent variables and the vaccination status of the students.

Given that the study participants were secondary students in Kajiado North Sub-County, the translation of the questionnaire from English to Swahili was essential to ensure inclusivity and clarity. While English is widely used in educational settings, Swahili is the predominant language for communication within families and communities in the region. The translation served two primary purposes: Firstly, parental consent and understanding. Although the primary respondents were secondary students, the consent process involved parents or guardians. Translating the questionnaire into Swahili ensured that parents could understand the content and intent of the questions. This was crucial for obtaining informed consent and fostering trust in the study process. Secondly, maximizing comprehension and accuracy. Some students were more comfortable expressing themselves in Swahili, especially when discussing personal or culturally sensitive topics. By providing the questionnaire in Swahili, we minimized the risk of misinterpretation or misunderstanding due to language barriers. This step was crucial for collecting accurate data and for participants to feel comfortable while responding.

3.7.1 Reliability and Validity of Instruments

To validate and refine the questionnaire, a pretesting phase was conducted by administering it to a group of 25 participants from nearby schools not included in the

main study. Despite the geographical proximity, we took specific steps to minimize the risk of contamination or information sharing between the pre-test and the primary study. The key measure to prevent contamination was selecting a boarding school for the pre-test that was not part of the main study. The boarding school setup provided a controlled environment where students remained within the school's premises during the entire data collection period, thereby limiting any interaction with students from other schools. This arrangement significantly reduced the chances of cross-contamination, as the pre-test participants had no opportunity to communicate with those participating in the primary study.

The "primary aim of the pretesting process was to assess the reliability of the questionnaire. To ensure reliability, Cronbach's alpha value was employed, with a threshold of 0.7 or above indicating satisfactory reliability. The questionnaires were administered through face-to-face interviews conducted in the classrooms, with the assistance of trained research assistants". This approach allowed for direct interaction with the participants, providing an opportunity to observe their responses and gather valuable feedback. By conducting this pretesting phase, we aimed to refine the questionnaire and ensure its effectiveness in capturing the intended data accurately and reliably.

Construct validity refers to the extent to which a test or instrument accurately measures the concept it is intended to measure. In the current study, the incorporation of construct validity measures was critical to ensuring that the questionnaire effectively captured the intended data, without ambiguity or misinterpretation.

To enhance construct validity, the study used various techniques. The primary step involved adopting questions from established studies with validated instruments. By

doing this, the study leveraged the rigorous testing and refinement that these questions had undergone in previous research, ensuring they were aligned with the constructs of the current study. This approach not only provided a foundation for the current research instrument but also reduced the need for extensive additional validation testing, saving time and resources.

Additionally, the study ensured that the adopted questions were contextually relevant to your target population in Kajiado North Sub County Schools. This relevance was crucial; as even validated questions can lose construct validity if they are applied in a different context without adaptation. By contextualizing the questions, the study ensured that they were culturally appropriate and understood by the participants, reducing the risk of misinterpretation. The process of construct validity also included expert consultation. By seeking input from experts in the field, the researcher was able to confirm that the questions reflected the constructs of interest. This step provided external validation and added credibility to the instrument.

Moreover, during the pretesting and pilot testing phases, feedback from participants was also carefully analysed to detect any inconsistencies or misunderstandings. If certain questions elicited varied interpretations or confusion, they were refined to maintain clarity and alignment with the constructs. This iterative feedback loop was vital in ensuring the construct validity of the questionnaire.

3.8 Data Collection Procedure

The data collection process for this study was meticulously designed to ensure coherence and effectiveness. It began with contacting the school administrators to explain the research objectives, potential benefits, and associated risks, which was crucial for obtaining the schools' informed assent and consent to participate in the study.

To demonstrate compliance, the researcher presented the authorization from the Kajiado County Educational Office for data collection.

Once approval was granted, the researcher scheduled visits to each school to coordinate data collection logistics. In boarding schools, sessions were organized during parent meetings, where the researcher explained the study's purpose and obtained informed consent from the parents. For day schools, students were given consent forms to take home, allowing their parents to review and sign before data collection began.

After parental approval, the researcher collaborated with the teachers in charge of forms 1 through 4 to determine the best times to collect data from students with parental consent. The data collection was scheduled to minimize disruptions to classroom learning, ensuring a smooth process for both the schools and the research team.

To conduct the data collection, the researcher was joined by two trained research assistants. The team worked closely with each school's administration to ensure minimal disruption to normal school activities while maximizing the efficiency of the study. Data collection was conducted through face-to-face interviews in the classrooms, with the research assistants engaging directly with the students.

Throughout the data collection sessions, the research team followed a standardized protocol to maintain consistency across all schools. This approach included guiding students through the questionnaire, addressing any questions or concerns, and closely monitoring the process to maintain a controlled environment.

3.9 Data Analysis and Presentation

To ensure confidentiality and proper data management, codes were used on all data collection tools instead of personal information like names. The data collected was carefully cleaned to maintain consistency in response formats. Data entry was performed within 24 hours of collection using SPSS version 25. The data was managed and analyzed using SPSS version 25.

To measure the level of knowledge about COVID-19 vaccination among the participants, the study used a set of four questions that targeted key aspects of vaccine understanding on awareness of the COVID-19 Vaccine, timing of protective immunity, allergic reactions towards COVID-19 vaccinations and legal mandate for vaccination.

Responses to these questions were categorized during the data preparation and transformation phase. If participants provided correct or positive responses, these were recorded as demonstrating "good knowledge." Conversely, if participants provided incorrect answers, their responses were recorded as demonstrating "poor knowledge." This transformation was carried out to facilitate further analysis, allowing the study to categorize participants into different knowledge levels based on their responses to these questions.

This approach provided a clear framework for assessing the knowledge levels of the study participants, allowing for meaningful comparisons and insights into their understanding of COVID-19 vaccination. By establishing this differentiation, the study was able to measure both good and poor knowledge, contributing to a robust analysis of the participants' awareness and understanding of key vaccination concepts. A similar transformation was also applied to the questions on attitude and practices leading to the

creation of categories positive attitude and negative attitude for attitude and passive measures and proactive measures for practices based on their questions.

In this study, associations were measured using statistical methods that are well-suited for categorical variables, specifically nominal and ordinal data. The data analysis employed both descriptive and inferential statistics to understand relationships among variables and draw meaningful conclusions.

Initially, the study used descriptive statistics, including frequencies and percentages, to summarize the characteristics of the study participants and to address the objective 1 to 3 on knowledge, attitude and practices. To determine the association between KAP and the type of school (boarding or day school), the Chi-square test was employed. In addition to the Chi-square test, logistic regression was used to analyze the socio demographic predictors of vaccine uptake. Logistic regression provided a way to identify which factors were significant predictors of vaccine uptake.

3.10 Ethical Considerations

The ethical procedures and guidelines followed for the study were extensive and rigorous, ensuring absolute respect for all involved parties. To commence the study, the researchers initially obtained approval from the Amref Ethics and Scientific Review Committee, guaranteeing the ethical robustness of the proposed research. Following this, the National Commission for Science, Technology and Innovations (NACOSTI) provided a research permit, further validating the integrity of the study upon ethical endorsement.

Moreover, additional authorization was obtained from the Kajiado County Educational office, which enabled data gathering in the specified schools. Participants' rights were explicitly preserved; their involvement was entirely voluntary, predicated on informed consent, the evidence of which is provided in Appendix 2. Confidentiality of the collected data was a paramount concern. No personal identifiers were incorporated in the final report, ensuring the anonymity of participants. This adherence to strict confidentiality and consent standards signifies the study's commitment to ethical research conduct. The study paid attention to the following considerations:

Respect for privacy;

Respect for privacy in the study was ensured by the use of pseudonym at all times during the study. Study participants were allowed to participate after the consent of parents and assent of students. No students were pressurized to participate in the study against his or her will. There was requirement to share any identifiable information with persons outside the research.

Confidentiality;

In the context of the study, the assurance of participant confidentiality was of utmost importance and was thoroughly addressed. The implementation of several rigorous strategies ensured this principle was upheld throughout the research process. The initial recruitment phase involved a random sampling method where unique codes were assigned to student registration numbers, thereby anonymizing the identity of each participant. These codes were only accessible to the principal researcher, thereby maintaining a strict level of confidentiality.

In the interest of transparency and protection of individual privacy, participants were made aware that they held the right to withhold any information they wished to remain private. Furthermore, they were informed of their unconditional right to refuse participation or to discontinue their involvement at any point during the research without any repercussions. Additionally, measures were taken to further anonymize individual data, employing the use of anonymous identifiers. A key safeguarding feature was the separation of raw data from files containing these anonymous identifiers linked to participant identities, ensuring that personal identification remains impossible and thereby enhancing the confidentiality of the research process.

Procedure of Obtaining Consent and Assent from Study Participants;

In an effort to ensure transparent and ethical practices, a well-defined procedure was followed to obtain the consent and assent from all involved parties. Initially, the researcher relied on the AMREF Ethics review permit to approach the Kajiado County Education office for their authorization. With their approval in hand, the researcher then approached the selected schools, presenting the research proposal to the principals. In these presentations, the study objectives and potential impacts were clearly outlined to garner their support and permission to conduct the study within their institutions. Having secured the principals' endorsement, the researcher then convened a meeting with the school management team, thoroughly discussing the study's intentions, the involvement required of both students and parents, and addressing any preliminary concerns.

Next, the researcher brokered an arrangement with the school management to present the study during the regular parents' association meetings. During these meetings, the

researcher detailed the study's aims, potential benefits, and any potential risks, ensuring that the parents were well-informed before providing their consent.

Once written parental consent was secured, the researcher then arranged discussions with the teachers of Form 1 to Form 4 to address any ethical concerns, inquiries, or potential issues that might arise in the course of the study. Only after this extensive process was the assent of the students sought, and only students with parental consent were allowed to participate in the study. The whole procedure was committed to transparency, ensuring that all parties were informed and comfortable with the process.

COVID-19 Prevention Measures;

The study adhered to the COVID-19 school guidelines issued by the Ministry of Education. In particular, the researcher ensured that all the research assistants have had masks on at all times and also the researcher provided hand wash sanitation detergents for use by the researcher assistants.

Right to Withdrawal Procedures;

The study ensured the right of the participant to withdraw from the study. After obtaining the parent consent the researcher sought the assent of the student. However, the student was given assent form and only allowed to provide their signature after two days. This allowed the students to consult with their parents on their participation. At the end of the two days, the researcher allowed the students who wanted to withdraw from the study to do so. To those who chose to withdraw their right were respected as decisions to persuade them to re-engage would not be pursued and they would not be coerced to participate. The participants were allowed to withdraw during the data collection process.

Study Risks;

Some of the participants are likely to experience emotional risks. The participants may experience some discomfort answering some of the questions due to a member of their family or personally having experienced COVID-19. The researcher took every effort to ensure participants felt comfortable, and participants were granted the right to decline to answer any particular questions to prevent such discomfort or to withdraw from the study.

Study Benefit;

Information used was helpful to provide insight on practices that can be used to prevent COVID-19 among students. This was highly essential in enabling school authorities to respond effectively to the outbreak of infectious diseases in the future.

CHAPTER 4: RESULTS

4.1. Introduction

This chapter offers a detailed analysis of the study's results. The research aimed to explore the levels of knowledge, attitudes, and preventive practices concerning COVID-19 among students in both day and boarding schools in Kajiado North Sub-County. Out of the 255 students initially targeted, 202 participated in the study, yielding a response rate of 79.2%.

The lower-than-expected response rate can be attributed to several factors. Some boarding schools did not secure comprehensive parental consent for their students' participation in the study, which limited the number of eligible respondents. Even when consent was obtained for certain students, the overall parental approval rate remained low, contributing to the reduced response rate.

Despite these challenges, the response rate of 79.2% provides a substantial dataset to draw insights and conclusions about COVID-19 knowledge, attitudes, and preventive practices among students in the study area. This is above the recommended response rate of COVID-19 studies of 60% (Franceschi et al., 2021). The findings presented in this chapter are in line with objectives of the study.

4.2. Socio-Demographic Characteristics of the Participants

In terms of age distribution, the majority of respondents fell into the 16-17 years category, representing 57.5% (n = 116), closely followed by those in the 18-19 years age group, making up 30.2% (n = 61) of the sample, while 12.4% (n = 25) belonged to the 14-15 years age group (*Table 1*). Regarding religious affiliation, the study revealed that 49.5% (n = 100) identified as Catholic, while 43.1% (n = 87) followed the

Protestant faith. A smaller proportion of respondents, 5.9% (*n* = 12), identified as Muslim, and just 1.5% (*n* = 3) described themselves as non-religious.

In terms of gender distribution, there was a slight majority of males, accounting for 54% (*n* = 109), compared to females, who represented 46% (*n* = 93) of the respondents. Among the participants, 53.0% (n = 107) of the attended day secondary schools, while 47.0% (*n* = 95) were enrolled in boarding secondary schools (*Table 1*). Finally, when it came to classes, the data showed that 31.2% (n = 63) of respondents were in Form Three, while 32.7% (*n* = 66) were in Form Four. A smaller proportion, 14.4% (*n* = 29), were in Form One, and 21.8% (*n* = 44) were in Form Two (*Table 4.1*).

Table 4. 1: Socio-demographic Characteristics of the Participants

Variable	Frequency (*N* =202)	Percentage (%)
Age		
14-15 Years	25	12.4
16-17years	116	57.5
18-19 years	61	30.2
Religion		
Catholic	100	49.5
Protestant	87	43.1
Muslim	12	5.9
Non-religious	3	1.5
Gender		
Male	109	54.0
Female	93	46.0
Type of School		
Day Secondary School	107	53.0
Boarding Secondary School	95	47.0
Classes		
Form One	29	14.3
Form Two	44	21.8
Form Three	63	31.2
Form Four	66	32.7

4.3. Covid-19 Vaccination Status among the Participants

The participants' vaccination status was ascertained by directly asking whether they had received the COVID-19 vaccine. Among the 202 participants, 62.9% (n = 127) reported being vaccinated, while 37.1% (n = 75) stated that they had not received the vaccine at the time of the survey (*figure 4.1*). This data provides valuable insights into the COVID-19 vaccination landscape among secondary students in the region. It indicates a notable proportion of students who have taken the proactive step of getting vaccinated, which is an encouraging sign in the ongoing efforts to combat the pandemic.

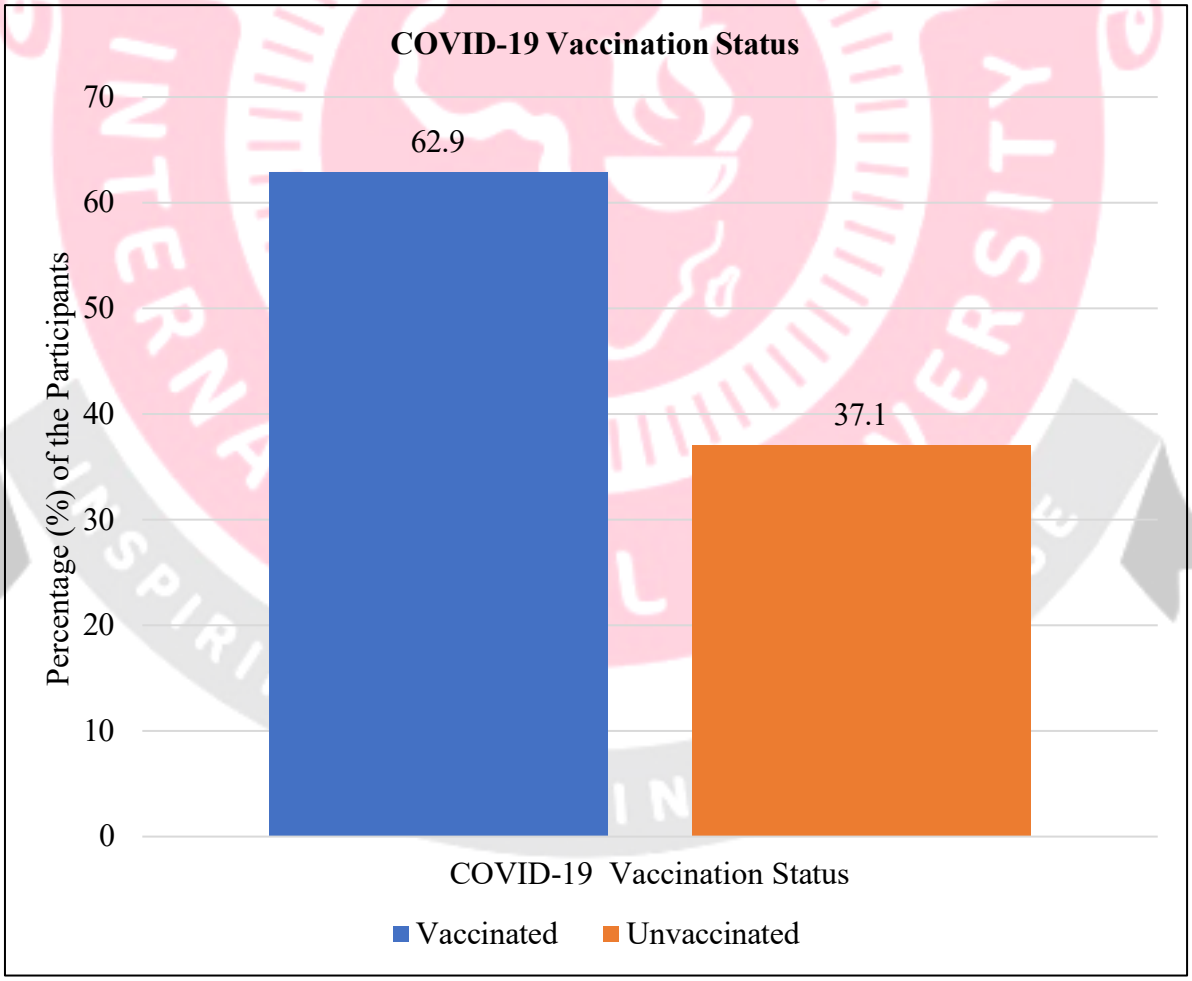

Figure 4. 1: COVID-19 Vaccination of the participants

4.4. The Knowledge on Covid-19 Vaccination

4.4.1. Participant Knowledge on Covid-19 Vaccination

This study assessed the knowledge level of students regarding COVID-19 vaccination in both day and boarding schools within Kajiado North Sub-County. This was done by asking the five questions; awareness of COVID-19 vaccine; when protective immunity against COVID-19 is achieved after vaccination; if COVID-19 vaccination increases allergic reaction; if it is legally mandatory to take COVID-19 vaccination; and the sources of information on COVID-19 Vaccine. Firstly, a significant majority of the 202 participants (95.0%, n = 192) reported being aware of COVID-19 vaccines, indicating a high level of awareness within the student population (Table 4.2).

Secondly, when asked about the timing of achieving protective immunity after COVID-19 vaccination, responses varied. Approximately 43.1% (n = 87) opined that protective immunity is attained after the first dose of vaccination, while 20.8% (n = 42) indicated it occurs after the second dose, and 10.4% (n = 21) thought it takes 14 days after the first dose. A notable portion (25.7%, n = 52) remained uncertain, highlighting the need for further education on this topic.

Concerning allergic reactions, only 3.9% (n = 8) of participants noted that COVID-19 vaccination increases such reactions, while the 43.1% (n = 87) did not share this concern, and 53.0% (n = 107) were unsure (Table 4.2). Lastly, regarding the perception of COVID-19 vaccination being legally mandatory, 21.2% (n = 43) of participants stated that it is legally mandatory, whereas 78.8% (n = 159) stated that it is not mandatory.

In terms of sources of information about COVID-19 vaccines, family members (28.5%, *n* = 190) were the most frequently cited source, followed by teachers (22.8%, *n* = 152), TV/Radio (25.1%, *n* = 167), social media (9.2%, *n* = 61), and health workers (5.9%, *n* = 39), emphasizing the diverse channels through which students gather information about vaccination (Table 4.2).

Table 4. 2: Knowledge of the Participants on COVID-19 Vaccination

Variable	Frequency (*N* =202)	Percentage (%)
Have heard about COVID-19 Vaccine		
Yes	192	95.0
No	10	5.0
When the protective immunity against COVID-19 is achieved after vaccination		
First Dose of Vaccination	87	43.1
Second Dose of Vaccination	42	20.8
14 days after First dose of Vaccination	21	10.4
I Don't Know	52	25.7
COVID-19 vaccination increases allergic reaction		
Yes	8	3.9
No	87	43.1
I Don't Know	107	53.0
It is legally mandatory to take COVID-19 vaccination	43	21.2
Yes	159	78.8
No		
Sources of Information on COVID-19 Vaccine		
Teachers	152	22.8
Family Members	190	28.5
Friends	57	8.6
TV/Radio	167	25.1
Social Media	61	9.2
Health Workers	39	5.9

4.4.2 Type of School Attended and Level of Knowledge

The level of knowledge about COVID-19 vaccination among the participants was measured through a set of four questions that targeted key aspects of vaccine understanding on awareness of the COVID-19 Vaccine, timing of protective immunity, allergic reactions towards COVID-19 vaccinations and legal mandate for vaccination. Responses to these questions were categorized during the data preparation and transformation phase. If participants provided correct or positive responses, these were recorded as demonstrating good knowledge. Conversely, if participants provided incorrect answers, their responses were recorded as demonstrating poor knowledge. The computed score of good and poor knowledge was used to conduct chi-square test between level of knowledge and category of school.

A chi-square ($\chi 2$) test was conducted to examine the association between school type and students' knowledge level on COVID-19 vaccination. The analysis revealed a non-significant relationship between the type of school attended and the level of knowledge on COVID-19 vaccination ($\chi 2 = .025$, $p = .874$) (Table 4.3). These findings suggest that the type of school attended does not significantly influence students' knowledge levels regarding COVID-19 vaccination.

Table 4. 3: Association between School Type and Students' Knowledge Level

Type of School	Vaccine knowledge		Chi Square Value	p-value
	Poor 9(4.5%)	Good 193(95.30%)		
Day Secondary School	5(4.70%)	102 (95.30%)	0.025	0.874
Boarding Secondary School	4 (4.20%)	91(95.80%)		

4.4.3 Knowledge Level and Vaccination Status

The results of the association between various knowledge variables and vaccination status, along with their corresponding Chi-square (X^2) values and p-values are shown in Table 4.3.

The results on awareness of COVID-19 vaccine" demonstrated a significant association with vaccination status. The Chi-square value for this variable was 6.213, with a p-value of 0.013. This indicated that awareness of the COVID-19 vaccine has a statistically significant relationship with vaccination status. This suggests that awareness of COVID-19 vaccine influences the uptake of the vaccine.

Table 4. 4: Associations between Knowledge Variables and Vaccination Status

Variables	**Vaccination Status**		**Chi Square Value**	**P-value**
	Vaccinated 127 (62.8%)	**Not vaccinated 75(37.2%)**		
COVID-19 Knowledge	117(60.9%)	75(39.1%%)	6.213	0.013
Lack of knowledge	10(100%)	0(0%)		

4.5. Attitudes towards Covid-19 Vaccination

4.5.1 Student Attitude towards Covid-19 Vaccination

The assessed the attitudes of students in both day and boarding schools within Kajiado North Sub-County towards COVID-19 vaccines. To gauge their attitudes, participants were asked to express their agreement or disagreement with five statements related to COVID-19 vaccination, including beliefs regarding its essentiality, its potential to reduce the pandemic, concerns about serious health issues, support for vaccination campaigns among students, and safety concerns about these vaccines. The findings revealed varying levels of agreement with these statements. Specifically, 57.4% (n = 116) of respondents agreed that COVID-19 vaccines are essential, underscoring their perceived importance. Similarly, a significant majority of 59.9% (n = 121) agreed that these vaccines have the potential to reduce the COVID-19 pandemic, indicating recognition of their role in public health (Table 4.5).

On the other hand, 24.3% (n = 49) expressed concerns that COVID-19 vaccines may lead to serious health issues, highlighting the existence of apprehensions about the vaccines from the students. Furthermore, an overwhelming majority of 66.8% (n = 135) voiced their support for COVID-19 vaccine campaigns among students, indicating a positive stance toward vaccination promotion efforts within the student community. Conversely, a substantial number of 44.1% (n = 89) disagreed with the statement that COVID-19 vaccines are unsafe for their health, reflecting a general level of confidence in vaccine safety.

Table 4. 5: Attitudes of the Students Towards Covid-19 Vaccination

Variable	Frequency (*N* =202)	Percentage (%)
Covid -19 vaccine is essential		
Agreed	116	57.4
Neutral	70	34.6
Disagree	16	8.0
COVID-19 vaccine can reduce COVID-19 pandemic	121	59.9
Agreed	79	39.1
Neutral	2	1
Disagree		
COVID 19 vaccine can lead to serious health issues	49	24.2
Agreed	104	51.6
Neutral	49	24.2
Disagree		
I support COVID-19 vaccine campaign amongst the students		
Agreed	135	66.8
Neutral	67	33.2
COVID-19 Vaccines is not safe for my health		
Agreed	25	12.4
Neutral	88	43.6
Disagree	89	44.1

4.5.2 Type of School Attended and The Attitude

The attitude of students towards the vaccination was measured through a set of questions that targeted key aspects of importance of vaccine, vaccine safety, health issues. The responses to the questions were categorized during the data preparation and

transformation phase. If participants expressed positive attitude to the questions, they were recorded as demonstrating positive attitude. On the contrary, if participants expressed negative attitude to any of the questions, their responses were recorded as demonstrating poor knowledge. The computed score of good and poor knowledge was used to conduct chi-square test between level of knowledge and category of school.

The results of the chi-square test for independence revealed a statistically significant association between the type of school and students' attitudes towards COVID-19 vaccination $X^2 = 1.72$, $p = .001$). These findings suggest that the type of school attended by students plays a significant role in shaping their attitudes regarding vaccination. Specifically, among participants from day secondary schools, a substantial majority, 85.0% ($n = 91$), exhibited a positive attitude towards COVID-19 vaccination, while only 15.0% ($n = 16$) expressed a negative attitude (Table 4.6). In contrast, among students from boarding secondary schools, a higher percentage, 34.7% ($n = 33$), held a negative attitude, while 65.3% ($n = 62$) displayed a positive attitude. This indicates a notable disparity in attitudes between the two school types, with students from boarding secondary schools exhibiting a comparatively higher proportion of negative attitudes. These findings underscore the significance of school type as a potential factor influencing students' perceptions and attitudes towards vaccination, which may have implications for targeted educational interventions.

Table 4. 6: Relationship between Type of School Attended and the Attitude

Type of School	Attitude		Chi Square Value	P-value
	Negative 49 (24.3%)	Positive 153(75.7%)		
Day Secondary School	16(15.00%)	91(85.00%)	10.729	0.001
Boarding Secondary School	33(34.70%)	62 (65.30%)		

4.5.3. Attitude and Vaccine Status

A chi-square test of independence was conducted to explore the association between attitudes towards vaccines and vaccination status, resulting in a non-significant chi-square value (X^2 = 0.909, p = .340) (Table 4.7). This suggests that there is no statistically significant association between students' attitudes towards vaccines and their vaccination status.

Table 4. 7: Association between Attitudes towards Vaccines and Vaccination Status

Attitudes	Vaccination		Chi Square Value	p-value
	Vaccination 127(62.8%)	Not Vaccinated 75(37.2%)		
Negative Attitude	48(59.3%)	33(40.7%)	1.527.	0.166
Positive Attitude	79(71.2%)	42(29.8%)		

4.6. Students' Practices towards Covid-19 Vaccination

4.6.1 Student Practices and Covid-19 Vaccination

The practices adopted by students in both day and boarding schools within Kajiado North Sub-County concerning COVID-19 vaccines were investigated through a comprehensive assessment of several key practices in regard to COVID-19 vaccination. The practices assessed included students' willingness to receive the COVID-19 vaccine, adherence to vaccination directives, registration on school platforms for vaccination, their inclination to recommend vaccination to family members, and their perception of vaccination as a fundamental public health issue.

The study's findings unveiled noteworthy trends within the student population. A significant majority, constituting 79.2% (n = 160) of respondents, indicated a strong inclination towards vaccination, demonstrating a high willingness to receive the COVID-19 vaccine. Furthermore, approximately 63.4% (n = 128) of the participants

reported adhering to vaccination directives, signifying a substantial rate of compliance among students. Moreover, an impressive 74.3% (n = 150) of students had registered on their school's vaccination platform, indicating active engagement in the vaccination process.

Additionally, more than half of the participants, specifically 58.4% (n = 118), expressed their readiness to recommend COVID-19 vaccination to a family member, reflecting a positive attitude towards vaccine promotion within their social circles. Furthermore, a substantial 67.8% (n = 137) of participants acknowledged the significance of vaccination as a public health issue, underscoring their awareness of its broader implications beyond individual protection. Collectively, these findings convey a favorable disposition towards COVID-19 vaccination practices among students in the study area.

Table 4. 8: Student's Practices Towards Covid-19 Vaccination

Variables	Frequency (*N*=202)	Percentage (%)
Willingness to Take Vaccine		
Disagreement	10	5.0
Neutral	32	15.8
Agreement	160	79.2
Following Vaccination Directives		
Disagreement	9	4.5
Neutral	65	32.2
Agreement	128	63.4
Registered on School Platform for Vaccination	7	3.5
Disagreement	45	22.3
Neutral	150	74.3
Agreement		
Willingness to Recommend a Family member		
Disagreement	34	16.8
Neutral	50	24.8
Agreement	118	58.4
Vaccination is an important public health issue	11	5.4
Disagreement	54	26.7
Neutral	137	67.8
Agreement		

4.6.2 Type of School Attended and Vaccination Practices

The chi-square test for independence produced a non-significant result (X^2= .209, p =.648), indicating that there is no statistically significant association between the type of school and the adoption of proactive or passive measures in response to COVID-19 vaccination (Table 4.9). These findings suggest that the type of school does not appear to significantly influence whether students adopt proactive or passive measures related to vaccination against COVID-19.

Table 4. 9: Relationship between Type of School Attended and COVID-19 Vaccination Practices

Type of School	Practices		Chi Square Value	p-Value
	Proactive 192(95%)	Passive 10 (5%)		
Day Secondary School	101(96.1%)	4(3.90%)	0.209	0.648
Boarding Secondary School	91(95.00)	6(5.00%)		

4.6.3 Vaccination Practices and Vaccination Status

A chi-square test of independence was performed to assess the association between practices towards vaccines and vaccination status. The results indicated that there is no statistically significant association between students' practices towards vaccines and their vaccination status (p =.087) (Table 4.10). Therefore, the students' practices do not appear to predict whether they are vaccinated or unvaccinated. This suggests other factors may have a more substantial influence on vaccination decisions among students.

Table 4. 10: Association between Practices towards Vaccines and Vaccination Status

Practice	Vaccination		Chi Square Value	P-value
	Vaccination 127(62.8%)	Not Vaccinated 75(37.2%)		
		75(4%)		
Passive Practices	10(71.4%%)	8(28.6%)	3.521	0.061
Proactive	117(63.5%)	67(36.7%)		

4.7 Association between Socio-Demographic and Covid-19 Vaccination Uptake

This section presents results of chi-square tests aimed to examine the association between socio-demographic factors and COVID-19 vaccination among students. Below is a detailed presentation of the results, along with their interpretation.

Table 4. 11: Association between Select Socio-Demographic Characteristics and COVID-19 Vaccination Among Students

Variables	Vaccine Status		Chi Square Value	P-value
	Vaccination 127(62.8)	Not Vaccinated 75(37.2%)		
Religion				
Catholic	63(63.6%)	36(36.8%)	2.714	0.145
Protestant	54(61.4%)	34(38.6%)		
Muslim	8(67%)	4(33%)		
Non-religious	2(66%)	1(37%)		
Gender			6.415	0.012
female	42(43.3%)	55(56.7%)		
male	85(90.9%)	20(19.1%)		
Age of Students			9.612	0.002
14-16 years	33(36.3%)	49(63.7%)		
17-19 years	94(87.3%%)	26(21.7%)		

For religion (DF = 3, $X^2 = 2.714$, p = 0.145), the p-value is greater than 0.05, suggesting no significant association between religion and vaccination status. The cross tabulation shows similar distributions across religious groups between vaccinated and unvaccinated individuals, reinforcing this conclusion.

On gender (DF = 1, $X^2 = 6.415$, p = 0.012), the p-value is less than 0.05, indicating a significant association between gender and vaccination status. Cross tabulation reveals that a higher percentage of females are unvaccinated compared to males, suggesting

that females are less likely to be vaccinated than males thus affirming that gender is associated with vaccination status.

For Age of Students (DF = 1, X^2 = 9.612, p = 0.002), the p-value is also less than 0.05, showing a significant association between age and vaccination status. The cross tabulation highlights that older students (17-19 years) are more likely to be vaccinated than younger students (14-16 years), indicating age impacts vaccination likelihood.

CHAPTER 5: DISCUSSIONS

5.1. Introduction

This chapter provides a comprehensive discussion of the findings, drawing insights from the data collected during the study. The main objective of the study was to investigate the knowledge level, attitudes, practices, and socio-demographic factors associated with COVID-19 vaccine uptake among students in both day and boarding schools in Kajiado North Sub-County. This chapter details an analysis of the result results in the context of existing literature, exploring the implications of our finding. The discussion is presented under the theme derived from the specific objectives of this study.

5.2. Knowledge Level of Students on Covid-19 Vaccination

This study aimed at determining the knowledge level of students regarding COVID-19 vaccination. The results indicated that a substantial majority of students over 95% of students in both day and boarding secondary schools demonstrated good knowledge of COVID-19 vaccination. This finding aligns with existing studies that reveal that nearly all the adolescent who participated in COVID-19 vaccination study were aware on the vaccine existence. (Oka et al., 2022; Purnama et al., 2023).

Previous studies have emphasized the importance of a well-informed population in achieving high vaccine uptake rates (Dubé et al., 2013). This knowledge not only influences individual vaccination decisions but also contributes to community immunity, a critical factor in controlling infectious diseases like COVID-19 (Larson et al., 2014). The findings contradict the results of a study conducted in Indonesia that found that knowledge level among adolescent and teenagers was only around 50% (Efendi et al., 2022; Mustain, 2022). The difference in findings between the current

study and the findings reporting contradicting findings is due the time when the time difference of the studies. These studies were conducted in early phase of COVID-19 vaccination when there was a lot of misinformation as opposed to the current study that was conducted in late phase of the pandemic where misinformation was reduced (Dhamayanti et al., 2024).

5.3. Attitudes of Students Towards Covid-19 Vaccines

The findings indicate that majority of students of students in both day and boarding schools have a positive attitude toward COVID-19 vaccination. This implies that secondary students in Kenya generally have a positive attitude towards the vaccine. The findings are similar to other international findings that 60 to 74% of secondary students in China and Bangladesh have positive attitudes on COVID-19 vaccination (Bhowmick et al., 2022; Cai et al., 2021; Talukder et al., 2024). However, other results have found much lower positive attitudes towards COVID-19 vaccination among students. For instance, in Switzerland, Leos-Toro et al. (2021) reported that majority of the students had negative attitudes.

The variation in students' attitudes toward COVID-19 vaccination across different geographic contexts, such as the observed lower positivity in Switzerland compared to higher rates in Kenya, China, and Bangladesh, can be attributed to a confluence of sociocultural, informational, and systemic factors (Humer et al., 2023). However, this study did not investigate the reason for positive attitude. Nonetheless, the findings reported that students with positive attitude were more in day secondary school than boarding secondary students. The observed difference in positive attitudes towards COVID-19 vaccination between students in day secondary schools and those in

boarding secondary schools could be attributed to school and environmental influence (Altman et al., 2023).

For instance, students in day schools may have more frequent interactions with their families and broader community, potentially reinforcing to the importance of cOVID-19 vaccination. In contrast, boarding school students often have a more controlled environment, which might limit the reinforcement of COVID-19 messaging to the students. This distinction is noted in studies like those by Tomas et al. (2023), which suggest that parental and community influences can significantly affect attitude of students towards COVID-19 vaccination.

5.4. Practices Adopted by Students Towards Covid-19 Vaccines

The findings indicate that over 90% of students in day and boarding secondary students have adopted proactive practices towards COVID-19 vaccine. This suggests that secondary students in Kajiado county have generally embraced positive behaviour change towards COVID-19 vaccination. Similar findings were echoed in the studies conducted in Netherlands and Sub-Saharan Africa where Euser et al. (2022) and Wang et al. (2022) reported that over 80% of the students were engaged in proactive practices towards COVID-19 vaccination. Nonetheless, a study conducted in Kenya reported that only 52% of youths interviewed have proactive practices towards COVID-19 vaccination (Osur et al., 2022).The discrepancy between the findings from the Osur et al. (2022) study, which reported only 52% of Kenyan youths engaging in proactive practices towards COVID-19 vaccination, and the current study indicating over 90% adoption of such practices among students in Kajiado County, can be attributed to targeting vaccination campaign that the government embarked on in secondary schools (Jerono, 2023).

5.5. Socio-Demographic Factors Associated with Vaccine Uptake

This study aimed to identify socio-demographic factors associated with vaccine uptake among students. The findings reveal that older students are more inclined to get vaccinated as compared to younger students. This can be attributed increased autonomy and responsibility among students as they age. As students age, they often assume greater control over their health decisions. Older adolescents may also face situations where they need to make independent health choices. This increased autonomy and personal responsibility for health can lead to higher rates of vaccine uptake (Mudenda et al., 2023). The influence of age on vaccination attitudes and practices has been observed in prior research. For example, a systematic review in Sub-Saharan Africa revealed that older adolescents are likely to be vaccinated against COVID-19 vaccine as compared to younger adolescents (Dhamayanti et al., 2024).

The findings show that females students are less likely to get vaccination as compared to male students. One possible explanation of the vaccine hesitancy amongst female students may relate to concerns about side effects and how it interacts with women health, more so menstrual cycle, conception, pregnancy and breastfeeding. Naturally, such concerns are likely to be higher older female students thus affecting vaccine uptake amongst women (Toshkov, 2023).

Other studies have found higher proportions of men compared with women reporting intention to getting the COVID-19 vaccine (Chinawa et al., 2023; Talukder et al., 2024). These studies have also highlighted that the difference in intention to getting vaccinated against COVID-19 between men and women is less about increased health-seeking behaviour in men and more about decreased health-seeking behaviour among women, which is consistent with existing literature on general vaccine hesitancy.

5.6. Limitations

Despite the valuable insights gained from this study, several limitations should be acknowledged. Firstly, the data collection procedure had significant limitation on the response rate. The study was granted permission by Kajiado County educational office only on condition that the research will be conducted to students whose parents have provided consents, given the sensitivity of COVID-19 vaccine amongst some parents. This affected the response rates of the study considerably. Related to this was non-cooperation of some of the secondary school administration despite having permission to collect data. The non-cooperation of some of the schools affected data collection process. However, the participating schools were still representative enough for the targeted school characteristics.

CHAPTER 6: SUMMARY, CONCLUSION, AND RECOMMENDATION

6.1 Summary

This study investigated the students' level of knowledge, attitudes, and preventive practices towards COVID-19 in day as well as boarding schools in Kajiado North Sub-County. First, the knowledge level of students regarding COVID-19 vaccination is notably high in both day and boarding schools, with over 95 % demonstrating good knowledge. Second, majority of the students exhibited a positive attitude toward COVID-19 vaccination, with most of the students with positive attitudes coming from day secondary schools. Third, an overwhelming majority of students (95.0%) in both day and boarding schools adopted proactive practices, signifying their readiness to engage with COVID-19 vaccination. Finally, socio-demographic factors reveal that age and level of education and category of school significantly influences vaccination positively while gender significantly influences vaccination negatively. Religion was found to be a non-significant predictor of vaccination uptake.

6.2. Conclusion

In conclusion, this research sheds light on the critical aspects of COVID-19 vaccination knowledge, attitudes, practices, and socio-demographic determinants among students in Kajiado North Sub-County.

6.2.1 Student Knowledge on COVID 19 Vaccination

The first objective of the study sought to determine the knowledge level of students on COVID-19 vaccination in day and boarding schools in Kajiado North Sub-County. The study concludes that the knowledge on COVID-19 vaccine in day and boarding schools in Kajiado North Sub-County is high. The study thus accepted the null hypothesis that there is no significant difference in the level of knowledge about COVID-19 vaccination between students in day schools and boarding schools in Kajiado North Sub-County.

6.2.2 Student Attitude on COVID-19 Vaccination

The second objective was to assess the attitude of students towards COVID-19 vaccines in day and boarding schools in Kajiado North Sub- County. Thus, study demonstrates that students in day secondary school have relative high positive attitudes as compared to students in boarding secondary school. Therefore, the study rejected the hypothesis that the attitude towards COVID-19 vaccines is the same among students in day schools and boarding schools in Kajiado North Sub-County.

6.2.3 Student Practices towards COVID-19 Vaccination

The third objective investigated the practices adopted by students towards COVID-19 vaccines in day and boarding schools in Kajiado North Sub- County. The study highlights that students in both day and secondary school have high proactive practices towards COVID-19 practices. Thus, the study accepted the hypothesis that there is no significant difference in the practices related to COVID-19 vaccination between students in day schools and boarding schools in Kajiado North Sub-County.

6.2.4 Association between Socio-demographic and COVID-19 Vaccination

The fourth objective of the study determined the socio-demographic factors associated with vaccine uptake amongst students in day and boarding schools in Kajiado North Sub-County. The study shows that age and gender is related to COVID-19 vaccination uptake. Therefore, the study rejected the hypothesis that there is no significant association between socio-demographic characteristics and COVID-19 vaccination in Kajiado North Sub-County.

6.3. Recommendations

6.3.1 Knowledge of Students towards COVID-19 Vaccination

Based on the finding, the following recommendation are made

1. School administrators and health educators should incorporate regular health education sessions that update students on the benefits of vaccination and new health guidelines
2. The Ministry of Education should develop policies that require the integration of pandemic response education within the school curriculum, in collaboration with public health authorities and curriculum developers.

6.3.2 Student Attitude towards COVID-19 Vaccination

Given the findings, the following specific recommendations are proposed:

1. The Ministry of Education, in collaboration with public health authorities and educational content developers, should develop mainstream student-friendly educational interventions and associated communication programs to enhance attitudes towards vaccination uptake in boarding schools.

2. School administrators in boarding schools should utilize school events and assemblies, in coordination with health educators and local health officials, to promote positive messages about COVID-19 vaccination, thereby improving students' attitudes towards vaccination.

6.3.3 Student Practices towards COVID-19 Vaccination

Based on the findings, the following specific recommendations are proposed:

1. Secondary school administrators, in collaboration with school health committees and student councils, should implement reward and recognition systems for students who demonstrate proactive vaccination behaviors.
2. Secondary school administrators, in coordination with the Ministry of Education and local health authorities, should continue to champion the need to follow and promote the Ministry of Education's guidelines on COVID-19 vaccine promotions.

6.3.4 Socio-Demographic Factors for Vaccine Uptake

Given the findings on socio-demographic factors, the following specific recommendations are proposed:

1. The Ministry of Health and the Ministry of Education, in collaboration with school administrators and public health researchers, should design and develop age- and gender-appropriate educational materials and activities to improve COVID-19 vaccination uptake among students.
2. School health committees, in partnership with local healthcare providers and community leaders, should organize workshops and seminars for parents and

students that highlight the importance of COVID-19 vaccination, with a focus on addressing the unique barriers faced by different age groups and genders.

6.4. Suggestions for Further Research

Future studies in this field should build upon the insights gained from this research and explore several avenues for further investigation. Firstly, there is need for studies that explore the reasons for vaccine hesitancy in secondary schools. Secondly, more future studies are needed on investigating the factors influencing knowledge, attitude and practices by students as the current study only investigated factors influencing vaccine uptake.

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APPENDICES

Appendix I: Parental Informed Consent

KAP STUDY ON COVID-19 VACCINATION AMONG SECONDARY STUDENTS IN KAJIADO NORTH SUB COUNTY IN KENYA

We invite you and your child to take part in a research study being conducted by Elizabeth Ombega of Master of Public Health in AMREF International University. The study focuses on investigating knowledge, attitudes, and practices of secondary students on COVID-19 vaccination in Kajiado North Sub County in Kenya. You are contacted as one of the parents to the students in participating schools. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Elizabeth ombega of Master of Public Health in AMREF International University, under the supervision of Dr. Shiphrah Kuria and Dr. Nzomo Mwita.

Risks and Benefits of Being in the Study:

There is limited risk associated with participating in this study as some questions may address sensitive issues on COVID-19. Those who may be affected by the sensitivity of the questions are free to withdraw and not participate in the study.

Participation in this study is voluntary. You have the right to withdraw from the study at any time and you may choose not to answer questions that make you uncomfortable. There is no penalty for choosing not to participate in this study.

A benefit of participation is providing a better understanding of the knowledge, attitudes, and practices of secondary students on COVID-19 vaccination in Kajiado North Sub County in Kenya. This can help researchers and practitioners develop better policies to control the spread of COVID-19 in secondary schools in Kenya.

Freedom to Withdraw or Refuse Participation:

I understand that my child has the right to withdraw at any time, or to refuse to answer any of the interviewer's questions without prejudice from the investigator.

Confidentiality:

All the responses will remain confidential. Data provided will be stored in a password protected database on a password protected computer. Personal identifiers will be replaced with a unique numeric code in the main database to prevent your identity from being connected with your information. A master list linking participants' unique numeric code with personal identifiers is stored on a separate password protected file that only the principal investigator has access to. The records of this study will be kept private and confidential to the extent permitted by the ethics review board. Any sort of report we might publish; we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only the researchers will have access to the records.

Voluntary Nature of the Study:

Participation in this study is voluntary. The decision whether or not to participate will not affect the student current or future relations with their secondary school. If you decide to participate, you are not obliged to share information you prefer to keep private and you can withdraw at any time without affecting this relationship. Should you have any questions on the study call Elizabeth Ombega on 0723729722 or send email to mwitaliz1@gmail.com.

In case you have questions on your rights as a study participant, kindly call AMREF ESRC on +254 795746777 or send email to esrc.kenya@amref.org

If you give permission for your child to participate in the study, please tick agree to participate. If you choose not to grant the permission of your child to participate tick agree not to participate.

Thank you for your time.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Agree to participate (name and signature): ……

Agree not to participate (name and signature): …….

Researcher (name and signature): ……..

Appendix II: Fomu Ya Ridhaa Ya Wazazi

UTAFITI KUHUSU MAARIFA, MWELEKEO NA MIENENDO KUHUSU CHANJO YA UGONJWA WA COVID-19 MIONGONI MWA WANAFUNZI WA SHULE ZA UPILI KATIKA KATA NDOGO YA KAJIADO-KASKAZINI, KENYA.

Tunakualika wewe pamoja na mtoto wako kushiriki katika utafiti huu unafanywa na Elizabeth Ombega, mwanafunzi wa shahada ya uzamili katika maswala ya afya ya umma katika chuo kikuu cha AMREF International University, chini ya usimimamizi wa Dr. Shiphrah Kuria and Dr. Nzomo Mwita. Utafiti huu unaochunguza maarifa, mwelekeo na mienendo kuhusu chanjo ya ugonjwa wa COVID-19 miongoni mwa wanafunzi wa shule za upili katika kata ndogo ya Kajiado-Kaskazini nchini Kenya. Ulichaguliwa kama mhusika mtarajiwa kwa sababu wewe ni mzazi katika shule ya upili husika. Tunakuomba usome fomu hii na uulize maswali yoyote kabla ya kumruhusu mtoto wako kushiriki katika utafiti huu.

Utafiti huu utafanywa na Elizabeth Ombega, mwanafunzi wa shahada ya uzamili katika maswala ya afya ya umma katika chuo kikuu cha AMREF International University, chini ya usimimamizi wa Dr. Shiphrah Kuria and Dr. Nzomo Mwita.

Manufaa na hatari ya kushiriki katika utafiti huu:

Kuna hatari chache zinazohusishwa na kushiriki katika utafiti huu kwa sababu baadhi ya maswali yatakayoulizwa yanahusisha maswala nyeti kuhusu ugonjwa wa COVID-19. Watakao hitaji msaada wanaweza kuwasiliana na wasimamizi wa ushauri nasaha shuleni.

Kushiriki katika utafiti huu ni kwa hiari ya mtu binafsi. Kila mshiriki ako huru kujitoa katika utafiti huu wakati wowote. Vilevile, washiriki wako huru kutojibu maswali yasiyowafurahisha. Hakuna yeyote atakayeadhibiwa kwa kutoshiriki katika utafiti huu.

Manufaa ya kushiriki katika utafiti huu ni kupokea uelewa bora wa maarifa, mielekeo na mienendo kuhusu chanjo dhidi ya ugonjwa wa COVID-19 miongoni mwa wanafunzi wa shule za upili katika kata ndogo ya Kajiado-Kaskazini, nchini Kenya. Hii itawasaidia watafiti na watekelezaji kuibua kanuni bora za kuzuia kuenea kwa ugonjwa wa COVID-19 katika shule za sekondari nchini Kenya.

Uhuru wa Kujiondoa Katika Utafiti huu:

Ninaelewa ya kuwa mtoto wangu ana uhuru was kutoshiriki katika utafiti huu na kutojibu maswali mengine ambayo yana mtatanisha. Mwanafunzi hatadhulumiwa kwakutoshiriki au kujiondoa katika utafiti huu.

Usiri:

Majibu ya mtoto wako yatafichuliwa kwa mtu mwingine. Ujumbe Utakaotolewa utahifadhiwa katika njia ya kutoonyesha jina la mtoto wako. Kumbukumbu ya utafiti huu itahifadhiwa kwa njia ya siri kulingana na kanuni za bodi ya maadili. Ripoti yoyote itakayochapishwa haitahusisha taarifa itakayotambulisha wahusika. Kumbukumbu za utafiti zitahifadhiwa katika eneo salama.

Uhusika wa Hiari katika Utafiti:

Kushiriki katika utafiti huu ni kwa hiari ya mtu binafsi. Kushiriki au kutoshiriki katika utafiti hakutaathiri uhusiano wako wa sasa au wa baadae na shule yako. Ukiamua kushiriki, sio lazima ujibu maswali na uko huru kujiondoa katika utafiti huu wakati wowote bila kuathiri uhusiano wako na shule yako. Ikiwa una swali lolote kuhusiana na utafiti huu unaweza kuwasiliana na Elizabeth Ombega kupitia kwa nambari ya simu 0723729722 au kupitia kwa barua pepe kupitia kwa mwitaliz1@gmail.com.

Ikiwa unamaswali kuhusu haki zako kama mhusika katika utafiti huu, tafadhali wasiliana na AMREF ESRC kupitia kwa +254 795746777 au unaweza kutuma barua pepe kupitia kwa esrc.kenya@amref.org

Ikiwa utakubali mtoto wako ashiriki katika utafiti huu jaza kisanduku. Kujaza kisanduku inamaanisha umekubali mtoto wako ashiriki katika utafiti huu. Ikiwa hautamruhusu mtoto wako kushiriki katika utafiti huu, jaza kisanduku cha kutoshiriki.

Asante kwa muda wako

Taarifa ya Ridhaa:

Nimesoma taarifa iliyo hapo juu. Nimeuliza maswali na nimepokea majibu.

Nimekubali kushiriki (jina na sahihi) ……

Sitashiriki (jina na sahihi) ……

Mtafiti (jina na sahihi) …….

Appendix III: Student Assent Form

You are invited to be in a research study investigating knowledge, attitudes, and practices of secondary students on COVID-19 vaccination in Kajiado North Sub County in Kenya. You were selected as a possible participant because you are a secondary school student. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Elizabeth Ombega of Master of Public Health in AMREF International University, under the supervision of Dr. Shiphrah Kuria and Dr. Nzomo Mwita.

Background Information:

The purpose of this study is to investigate knowledge, attitudes, and practices of secondary students on COVID-19 vaccination in Kajiado North Sub County in Kenya

Procedures:

If you agree to be in this study, we would ask you to complete a questionnaire which is expected to take 5-10 minutes to complete.

Risks and Benefits of Being in the Study:

There is limited risk associated with participating in this study as some questions may address sensitive issues. Those who wish to seek assistance with these issues should contact the Guidance and counselling master at the school.

Participation in this study is voluntary. You have the right to withdraw from the study at any time and you may choose not to answer questions that make you uncomfortable. There is no penalty for choosing not to participate in this study.

A benefit of participation is providing a better understanding of the knowledge, attitudes, and preventive practices of secondary students on COVID-19 in Kajiado North Sub County in Kenya. This can help researchers and practitioners develop better policies to control the spread of COVID-19 in secondary schools in Kenya.

Confidentiality:

Your responses will remain confidential. Your data will be stored in a password protected database on a password protected computer. Personal identifiers will be used to identify you in the study.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with your secondary school. If you decide to participate, you are not obliged to share information you prefer to keep private and you can withdraw at any time without affecting this relationship.

If you agree to participate in the study, please tick agree to participate. If you choose not to participate tick agree not to participate.

Thank you for your time.

Statement of Assent:

I have read the above information. I have asked questions and have received answers. I assent to participate in the study.

Agree to participate (name and signature): ……

Agree not to participate (name and signature): …….

Researcher (name and signature): …….

Appendix IV: Fomu Ya Ridhaa Ya Wanafunzi

Tunakualika ushiriki katika utafiti huu unaochunguza maarifa, mwelekeo na mienendo kuhusu chanjo ya ugonjwa wa COVID-19 miongoni mwa wanafunzi wa shule za upili katika kata ndogo ya Kajiado-Kaskazini nchini Kenya. Ulichaguliwa kama mhusika mtarajiwa kwa sababu wewe ni mwanafunzi wa shule ya upili. Tunakuomba usome fomu hii na uulize maswali yoyote kabla ya kushiriki katika utafiti huu.

unafanywa na Elizabeth Ombega, mwanafunzi wa shahada ya uzamili katika maswala ya afya ya umma katika chuo kikuu cha AMREF International University, chini ya usimimamizi wa Dr. Shiphrah Kuria and Dr. Nzomo Mwita. Utafiti huu

Utafiti huu utafanywa na Elizabeth Ombega, mwanafunzi wa shahada ya uzamili katika maswala ya afya ya umma katika chuo kikuu cha AMREF International University, chini ya usimimamizi wa Dr. Shiphrah Kuria and Dr. Nzomo Mwita.

Kusudi la Utafiti

Kusudi la utafiti huu ni kuchunguza maarifa, mwelekeo na mienendo kuhusu chanjo ya ugonjwa wa COVID-19 miongoni mwa wanafunzi wa shule za upili katika kata ndogo ya Kajiado-Kaskazini nchini Kenya.

Utaratibu:

Ikiwa utakubali kushiriki katika utafiti huu, utahitajika kujaza dodoso utakayo tarajiwa kuikamilisha kati ya dakika tano na dakika kumi.

Manufaa na hatari ya kushiriki katika utafiti huu:

Kuna hatari chache zinazohusishwa na kushiriki katika utafiti huu kwa sababu baadhi ya maswali yatakayoulizwa yanahusisha maswala nyeti kuhusu ugonjwa wa COVID-19. Watakao hitaji msaada wanaweza kuwasiliana na wasimamizi wa ushauri nasaha shuleni.

Kushiriki katika utafiti huu ni kwa hiari ya mtu binafsi. Kila mshiriki ako huru kujitoa katika utafiti huu wakati wowote. Vilevile, washiriki wako huru kutojibu maswali yasiyowafurahisha. Hakuna yeyote atakayeadhibiwa kwa kutoshiriki katika utafiti huu.

Manufaa ya kushiriki katika utafiti huu ni kupokea uelewa bora wa maarifa, mielekeo na mienendo kuhusu chanjo dhidi ya ugonjwa wa COVID-19 miongoni mwa wanafunzi

wa shule za upili katika kata ndogo ya Kajiado-Kaskazini, nchini Kenya. Hii itawasaidia watafiti na watekelezaji kuibua kanuni bora za kuzuia kuenea kwa ugonjwa wa COVID-19 katika shule za sekondari.

Usiri:

Majibu ya mtoto wako yatafichuliwa kwa mtu mwingine. Ujumbe Utakaotolewa utahifadhiwa katika njia ya kutoonyesha jina la mtoto wako. Kumbukumbu ya utafiti huu itahifadhiwa kwa njia ya siri kulingana na kanuni za bodi ya maadili. Ripoti yoyote itakayochapishwa haitahusisha taarifa itakayotambulisha wahusika. Kumbukumbu za utafiti zitahifadhiwa katika eneo salama.

Uhusika wa Hiari katika Utafiti:

Kushiriki katika utafiti huu ni kwa hiari ya mtu binafsi. Kushiriki au kutoshiriki katika utafiti hakutaathiri uhusiano wako wa sasa au wa baadae na shule yako. Ukiamua kushiriki, sio lazima ujibu maswali na uko huru kujiondoa katika utafiti huu wakati wowote bila kuathiri uhusiano wako na shule yako.

Ikiwa utakubali mtoto wako ashiriki katika utafiti huu jaza kisanduku. Kujaza kisanduku inamaanisha umekubali mtoto wako ashiriki katika utafiti huu. Ikiwa hautamruhusu mtoto wako kushiriki katika utafiti huu, jaza kisanduku cha kutoshiriki.

Asante kwa muda wako

Taarifa ya Ridhaa:

Nimesoma taarifa iliyo hapo juu. Nimeuliza maswali na nimepokea majibu.

Nimekubali kushiriki (jina na sahihi) ……

Sitashiriki (jina na sahihi) ……

Mtafiti (jina na sahihi) …….

Appendix V: ESRC Approval Documents

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Please do not hesitate to contact the ESRC Secretariat (esrc.kenya@amref.org) for any clarification or query.

Yours sincerely,

AMREF - ESRC
21 OCT 2022
P.O. Box 30125-00100, NAIROBI

Prof. Mohamed Karama
Chair, Amref ESRC
CC: Samuel Muhuta, Monitoring & Evaluation and Research Manager, Amref Health Africa in Kenya.

NACOSTI PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **599638**

Date of Issue: **21/November/2022**

RESEARCH LICENSE

This is to Certify that Ms.. Elizabeth Magoma Ombega of Amref International University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kajiado on the topic: KNOWLEDGE, ATTITUDES, AND PRACTICES TOWARDS COVID-19 VACCINATION AMONG SECONDARY STUDENTS IN KAJIADO NORTH SUB COUNTY IN KENYA for the period ending : 21/November/2023.

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See overleaf for conditions

KAJIADO NORTH SUB-COUNTY PERMISSION LETTER

Ministry of Education

Kajiado North Sub County Education Director
P. O. BOX 560 – 01100
Ngong Hills
8th January 2023

Ref No: MOE/KNSE/M8

ALL HEADTEACHERS OF SECONDARY SCHOOLS

RE: Authorization for Data Collection by MPH Student

Please be informed that Ms. Elizabeth Ombega, an MPH student at AMREF University, Reg No: /MPH/3841-1/2021, has been granted permission to collect data from students at your institutions. This research is part of her academic requirements and her study focuses on "Knowledge, Attitudes, Practices of COVID-19 Vaccination among Secondary Students in Kajiado North Sub County, Kenya"

Due to the sensitive nature of the COVID-19 vaccine topic, it is mandatory that parental consent is obtained before any data collection begins. Please ensure this protocol is followed strictly.

Thank you for your cooperation.

Sincerely,

John Njoroge
Kajiado North Sub County Educational Director

Appendix VI: Questionnaire

SECTION A: DEMOGRAPHIC

1. Name of School
2. Age**:** _____
3. Sex: [ ] Male [ ] Female
4. Year in School [ ] Form 3 [ ] Form 4
5. Religion [ ] Catholic [ ] Protestant [ ] Muslim [ ] Non-religious
6. Have you taken COVI-19 vaccine
   [ ] Yes (First dose) [ ] Yes (both doses) [ ] No

SECTION B: KNOWLEDGE ON COVID-19 Vaccination

7. It is legally mandatory to take COVID-19 vaccine
   [ ] Yes [ ] No [ ] I don't Know

8. Have you heard about the coronavirus disease 2019 (COVID-19) vaccine?
   [ ] Yes

   [ ] No

9. Who/ what was the main source of the information on about the coronavirus disease 2019 (COVID-19) vaccine- Select all that apply
   [ ] Teachers

   [ ] Family Members

   [ ] Friends

   [ ] Television and Radio

   [ ] Social Media

   [ ] Health Worker

10. Protective immunity against COVI-19 infection is achieved after
    [ ] First dose of vaccination [ ] Second dose of vaccination [ ] Fourteen

    dose after the first dose of vaccination [ ] I don't know

11. Does vaccination increase allergic reactions?
    [ ] Yes [ ] No [ ] I don't Know

DODOSO

SEHEMU YA KWANZA: DEMOGRAFIA

1. Jina la Shule
2. Umri**:** _____
3. Jinsia: [ ] Kiume [ ] Kike
4. Kidato shulenu[ ] Kidato cha tatu [ ] Kidato cha nne
5. Dini [ ] Mkatoliki [ ] Mlokole [ ] Muislamu [ ] Bila dini
6. Umepokea Chanjo dhidi ya COVI-19 vaccine
   [ ] Ndio (Chanjo ya kwanza) [ ] (Chanjo zote mbili) [ ] La

SEHEMU YA PILI: MAARIFA KUHUSU CHANJO YA COVID-19

7. Kisheria ni lazima mtu apokee chanjo dhidi ya COVID-19
   [ ] Ndio [ ] La [ ] Sifahamu

8. Umesikia chochote kuhusu chanjo dhidi ya COVID 19?
   [ ] Ndio

   [ ] La

9. Ulipata ujumbe kuhusu chanjo dhidi ya COVID 19 kutoka wapi au kwa nani?
   [ ] Waalimu

   [ ] Familia

   [ ] Marafiki

   [ ] Runinga na Redio

   [ ] Mitandao ya kijamii

   [ ] Wahudumu wa afya

10. Mtu hupata kinga kamili dhidi ya ugonjwa wa COVID-19 baada ya
    [ ] Chanjo ya Kwanza [ ] Chanjo ya pili [ ] Siku kumi nan ne baada ya

    chanjo ya kwanza [ ] Sifahamu

11. Utumiaji wa chanjo dhidi ya COVID-19 unasababisha mzio?
    [ ] Ndio [ ] La [ ] Sifahamu

ATTITUDE TOWARDS COVID-19

INSTRUCTIONS: For the following questions, you are asked to respond using the following scale: Scale: Strongly Disagree = 1: Disagree= 2: Neutral = 3: Agree = 4: Strongly Agree = 5

Statement	**1**	**2**	**3**	**4**	**5**
I feel COVID-19 vaccine is essential					
COVID-19 vaccine can reduce the effects of COVID-19 pandemic					
I believe that COVID 19 vaccine can lead to serious health issues					
I support COVID-19 vaccine campaign amongst the students					
I believe that COVID-19 Vaccines is not safe for my health					
I am sure the COVID-19 vaccines will be effective in preventing me from COVID-19 infection					

MWELEKEO KUHUSU COVID-19

Maagizo: Kwa maswali yafuatayo, unahitajika kujibu kwa kutumia mizani ifuatayo: 1-Sikubaliani kabisa=1: Sikubaliani= 2 sikubaliani na sikatai (siko upande wowote) =3 Nakubaliana=4 Nakubaliana Kabisa=5

Statement	**1**	**2**	**3**	**4**	**5**
Nahisi kuwa chanjo dhidi ya COVID-19 ni muhimu					

Chanjo dhidi ya COVID-19 inaweza punguza kuenea kwa janga la COVID-19					
Naamini kuwa kupokea chanjo ya COVID-19 kunaweza sababisha madhara mabaya ya kiafya					
Ninaunga mkono kampeni kuhusu chanjo ya COVID-19 miongoni mwa wanafunzi					
Naamini kuwa chanjo dhidi ya COVID-19 inaweza dhuru afya yangu					
Ninaamini kuwa chanjo dhidi ya COVID-19 itafanikiwa kunizuia kuumbukizwa ugonjwa wa COVID-19					

PRACTICES TOWARDS COVID-19 vaccination

12. Do you agree to the following statements on preventive practices in response to the coronavirus pandemic? The following scale will be used 1 strongly agree 5 strongly disagree

Statement	**1**	**2**	**3**	**4**	**5**
I am willing to take COVID-19 vaccination when called upon to					
I follow the vaccination plan identified by the Ministry of Health					
I have been registered on the school platform for COVID-19 vaccination					
I am willing to recommend a family member to take COVID-19 vaccine after taking my vaccine					

I consider receiving the COVID-19 vaccine as an important public health measure.					

MIENENDO KUHUSU CHANJO YA COVID-19

12 Unakubaliana na kauli zifuatazo kuhusu mienenendo ya kuzuia janga la korona? Jibu ukitumia mizani ifuatayo: 1-Sikubaliani kabisa=1: Sikubaliani= 2 sikubaliani na sikatai (siko upande wowote) =3 Nakubaliana=4 Nakubaliana Kabisa=5

Statement	**1**	**2**	**3**	**4**	**5**
Niko tayari kupokea chanjo ya korona nitakapo hitajika nifanye hivyo					
Ninafuata maagizo yaliyotolewa nan a wizara ya afya kuhusu upokezi wa chanjo ya korona					
Nimesajiliwa jukwaa la shule kuhusu chanjo dhidi ya COVID-19					
Niko tayari kumwelekeza mtu wa familia yangu apokee chanjo ya korona baada ya kupokea chanjo dhidi ya COVID-19					

Appendix VII: Progress of Publication

EM East African Medical... Yesterday
To: Liz Mwita >

Re: MANUSCRIPT SUBMISSION FOR PUBLICATION

Dear Elizabeth,

The manuscript is under review.

Please let us wait for review comments.

We will give an update soon.

Thank you.

Virus-free.www.avast.com

On Thu, Jul 4, 2024 at 1:58 PM Liz

Appendix VIII: Similarity Report

KAPS KAJIADO NORTH

ORIGINALITY REPORT

12%	9%	6%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	erepository.uonbi.ac.ke Internet Source	1%
2	ir.cuea.edu Internet Source	<1%
3	Melsew Setegn Alie, Gossa Fetene Abebe, Yilkal Negesse, Simegnew Gichew. "Prevalence and determinants to COVID-19 vaccine hesitancy among people living with HIV in Bench Sheko zone, Southwest Ethiopia: A multi-center study", Heliyon, 2024 Publication	<1%
4	www.pmadata.org Internet Source	<1%
5	www.researchgate.net Internet Source	<1%
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