DETERMINANTS OF COVID-19 VACCINE UPTAKE AMONG ADULTS IN MWALA SUBCOUNTY, MACHAKOS COUNTY, KENYA

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE IN EPIDEMIOLOGY AND DISEASE CONTROL OF

MOUNT KENYA UNIVERSITY

JULY 2023

DECLARATION AND APPROVAL

DECLARATION AND APPROVAL

DECLARATION BY THE STUDENT

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

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DEDICATION

I dedicate this work to my parents Mr. Peter Kilonzo and Mrs. Josephine Kimolo for their support throughout the process.

ACKNOWLEDGEMENTS

Firstly, I accord my sincere gratitude to God for leading me through my research project process. In addition, I want to especially thank my supervisors (Dr. John G. Kariuki, Ph D and Dr. Samuel M. Karenga, Ph D) for their advice and timely feedback whenever necessary.

I also appreciate Mwala Sub County health management team for their support and ample time over the period I was carrying out my research.

I additionally thank Mount Kenya University IERC and NACOSTI for approving my work and allowing me carry my thesis to completion.

ABSTRACT

COVID-19 has had immense negative effects on different populations both economically and socially. Since the pandemic started in 2019, it has caused numerous deaths and lowered quality of life among various victims and survivors. In efforts to contain the pandemic, virologists and vaccine manufacturers have worked and invented different COVID-19 vaccine variants with diverse but remarkably good levels of efficacy against the disease. Despite the Kenyan government's efforts to make the vaccines available to the eligible population, vaccine hesitancy and refusal has brought about poor uptake hence slowing down the vaccination process. In this regard, the broad objective was to investigate the determinants of COVID-19 vaccine uptake among adults. The specific objectives were to identify the individual, administrative, social, and demographic factors that influence COVID-19 vaccine uptake among adults in Mwala Sub-county. It engaged the adult population residing in Mwala sub-county, Machakos County, Kenya as the study participants only. Analytical cross-sectional study design was used to achieve these objectives. Ethical clearance was issued by Mount Kenya University Ethical Review Committee and NACOSTI before data collection. The study targeted residents of Mwala Sub-county aged above 18 years of age. Data collection was carried out by means of structured questionnaires administered to 384 respondents and key informant interview guides that engaged six informants. The questionnaire respondents were sampled using systematic random sampling method from individuals visiting the six vaccination centres in the Sub-county. The process adhered to ethical considerations of informed consent, confidentiality, and anonymity. Data analysis was done with the aid of the SPSS software version 26. Descriptive analysis was conducted to describe the socio-demographic findings of the study as well as COVID-19 vaccine uptake of the respondents. Uptake of the first dose was 46.60% while fully vaccinated individuals were 11.70% of the total number of respondents. The association between some variables was identified through Chi-square test of association at significance level p=0.05. There were statistically significant associations between the outcome variable (COVID-19 vaccine uptake) and demographic predictors of age (χ^2=15.524, df=3, P=0.001), sex (χ^2=5.250, df=1, P=0.022), education level (χ^2=107.556, df=3, P<0.001), and marital status (χ^2=35.328, df=3, P<0.001). Additionally, social factors such as dependence on unreliable sources of information (χ^2=32.904, df=3, P<0.001), collective responsibility of getting vaccinated to protect others (χ^2=292.931, df=3, P<0.001), and religious teachings (χ^2=11.763, df=1, p=0.001) also exhibited significant associations. Among predictors of low vaccine uptake was individual factors of susceptibility perception (χ^2=189.471, df=1, p<0.001), severity perception (χ^2=234.515, df=3, P<0.001), safety concerns (χ^2=277.624, df=3, P<0.001), and perception that the vaccine benefits did not outdo associated side effects (χ^2=277.624, df=3, P<0.001). Administrative factors of vaccine stock-outs (OR = 0.86, 95% CI 0.82 – 0.90) and long queues (OR=0.87, CI 95% 0.83–0.90) were not significantly related to the outcome variable. The study concludes that the vaccine uptake in Mwala is generally low. To overcome the low vaccine uptake, the government should incorporate COVID-19 vaccination into the existing routine vaccination schedule and address conspiracy theories revolving around the vaccine in various social media sites during health education and awareness vaccination campaigns.

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COVID-19 - Coronavirus Disease 2019

EUL - Emergency Use Listing

KII – Key Informant Interview

LMIC – Low-and Middle-Income Countries

PHEIC - Public Health Emergency of International Concern

PPE - Personal Protective Equipment

SARS-CoV-2 - Severe Acute Respiratory Syndrome Coronavirus 2

WHO - World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study:

Coronavirus disease 2019 (COVID-19) is a newly identified illness attributable to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Zoller *et al*., 2020). The origin of this ailment can be traced back to Wuhan, China where it originated towards the end of 2019 before spreading to other countries across the world. Evidence suggests that the mode of transmission for COVID-19 can either be direct or indirect via infected secretions such as saliva droplets. These droplets can be spread from an infected individual to a susceptible individual through coughs, sneezes or even talks. Magnavita *et al*., (2020) argue out that dry cough, fever, and tiredness are among the most presenting symptoms of COVID-19.

Multiple studies agree on certain basic mitigation and control strategies against the disease among them hand hygiene, which can be achieved through handwashing with the aid of soap and water as well as sanitizing of hands using alcohol-based hand sanitizers. Additionally, World Health Organization (2020) recommends wearing of face masks in public places. This has proven to be an effective prevention strategy embarked on blocking of the main portals of entry, which are nose and mouth.

The fact that COVID-19 posed a potential threat to the health of individuals from nations that were not initially affected, saw it enlisted as Public Health Emergency of International Concern (PHEIC) (WHO, 2020). Despite initial strategies put in place to control the disease, it continued to spread into other countries around the globe. In this regard, COVID-19 was then confirmed a global pandemic.

Different control and prevention community strategies against COVID-19 have been in place since its emergence in 2019 and have had a notable impact on reducing the

disease burden and associated deaths. However, to completely eliminate and eradicate the disease, mass vaccination against the latter is necessary. As the hunt for vaccines still goes on, the World Health Organization (WHO) continues to approve and add more vaccines into its Emergency Use Listing (EUL). The WHO has approved Pfizer/BionTech, CanSino, Astrazeneca, COVAXIN, Janssen, Sinovac, Moderna, and Sinopharm COVID-19 vaccines (WHO, 2021). Subsequent studies conducted on these vaccines have all found them effective in the efforts to combat COVID-19 transmissions. For instance, a survey carried out by Hall *et al*., (2021) realized a notably high effectiveness with the Pfizer COVID-19 vaccine. Further, Moghadas (2021) revealed that COVID-19 vaccines significantly lowered the disease attack rate among the vaccinated populations in the US. Therefore, this implies that an improved uptake of COVID-19 vaccine in all countries could effectively contain the global pandemic. Despite the need to vaccinate the whole population, need-based prioritization is advisable whereby the elderly and healthcare workers are vaccinated first (Hanif *et al*., 2020).

Dodd *et al*., (2021) brought forth evidence which revealed out several key motivators that encourage various population groups to seek COVID-19 vaccination services. For instance, Štěpánek *et al*., (2021) points out that getting vaccinated against COVID-19 in the bid to protect close friends and family members is one of the major and common motivating factors to seeking the services. In addition, Fekete *et al*., (2023) found out that having a chronic illness could be a motivating factor to acceptance of COVID-19 vaccine. In this regard, they engaged Hungarian residents with Chronic Obstructive Pulmonary Disease (COPD) from whom they realized that majority were already fully vaccinated. This was quite crucial in the avoidance of complications that may be occasioned by COVID-19 infection besides the underlying chronic illnesses. Vallée *et*

al., (2021) recommend full acceptance of COVID-19 vaccine by French nationals diagnosed with HIV/AIDS in order to avoid complications and severity that may be brought about by COVID-19 infection. Further, Anino et al., (2023) associate chronic illnesses with having higher intentions to acquire COVID-19 vaccination services among the elderly residents of Kericho County (AOR = 2.12; 95% CI = 1.53-3.37).

Regionally, the Sub-Saharan Africa has been adversely affected by COVID-19 in diverse ways. Some of the interventions implemented with an aim of controlling the spread of the infection and contain the pandemic among them lockdowns have had direct economic impact on the region (Bitanihirwe and Ssewanyana, 2021). A review by Belitski *et al*., (2022) further points out the immense negative impact COVID-19 pandemic has had on the small businesses. Evidence suggests that in the bid to contain the pandemic, governments around the world have directed much attention towards the fight to counter the transmission of the COVID-19 virus over other diseases that still pose public health challenges. For instance, Luciani *et al*., (2022) point out a notable disruption of the implementation of strategies targeting non-infectious diseases brought forth by COVID-19 pandemic in the United States. This situation is not limited to the US only but the effects can be felt in other countries across the world. This has in turn affected the public expenditure on health thus affecting different health programs. Despite the noted effects, several studies have realised COVID-19 vaccine hesitancy among individuals of diverse nationalities within the region once the vaccines are availed to the general public. For instance, Acheampong *et al*., (2021) noted that only 51% of the Ghanaian adult population was ready to take up vaccines against COVID-19 after they are made available for use by the general community; a slightly lower population than that needed for herd immunity.

Slow acceptance of the COVID-19 vaccination services has been noted across African nations with majority of them recording a huge hesitancy (Mutombo *et al*., 2022). In Zambia, a great level of vaccine hesitancy and refusal was recorded among citizens visiting various healthcare facilities with majority of them raising safety and efficacy concerns on the COVID-19 vaccine (Carcelen *et al*., 2022). In their study on uptake of the vaccine, Nzaji *et al*., (2021) discovered that only 27.70% of the Congolese healthcare providers were ready to seek out vaccination services against COVID-19 once the doses were availed to them. In Nigeria, a research study performed by Iwu *et al*., (2022) found out that 35.4% of the healthcare staffs were still undecided whether to take up COVID-19 vaccination services or not. With some of the healthcare workers still having doubts on the safety and significance of the vaccine, uptake of the same services is highly likely to be low among the general public who are less informed about the latter as compared to the medics.

A research study done across six low-and-middle-income nations among them Kenya noted a low vaccination intent against COVID-19. Despite the fact that this study was done before arrival of the vaccines ordered by the Kenyan government and beginning of the vaccination exercise, the situation could still be persistent despite availability of the vaccines (Kebede *et al*., 2021). By 22nd June 2022, Kenya had reported 330,478 total cumulative cases of COVID-19 and 5,651 cumulative fatalities. Through the Ministry of Health, Kenya started the vaccination exercise against COVID-19 in March 2021. The campaign started with populations at great risk such as the frontline healthcare personnel, security staffs, teachers, and people aged 58 years or more. With increased number of vaccines, the campaign was later on extended to cover the general adult population in a bid to help the country attain herd immunity against the disease. However, low uptake of the vaccines has been noted in the statistics on the vaccination

exercise as availed by the ministry of health. As per the situation reports by the Ministry of Health, Kenya, Machakos County had fully vaccinated 314,208 individuals against a target of 905,172 as at 22nd June 2022 (34.70% of the total population in the county). Hence, this research study investigated determinants of COVID-19 vaccine uptake amidst adults.

1.2 Statement of the Problem:

Since the primary case was confirmed in December 2019, COVID-19 has had devastating effects on different populations globally. To effectively control the pandemic, efforts have been put in place in the hunt for vaccines in different countries. However, some studies conducted on uptake of COVID-19 vaccines are indicative of a notably slow uptake of the latter.

In developing nations, among them Kenya, low vaccine uptake may be associated with not only vaccine hesitancy but also availability of the vaccines and social media propaganda among other factors. Previous studies conducted to determine factors associated with low immunisation coverage in Kenya noted that religious beliefs were also significant barriers and therefore, this could also be affecting the COVID-19 vaccination exercise.

With the low vaccination rates, it may take quite a long time for the Kenyan population to gain herd immunity against the disease and this implies continued COVID-19 propagated infections. In fact, the Ministry of Health reported that as at 22nd June 2022, only 8,599,067 adults (31.60% of all adults across the country) had acquired full COVID-19 vaccination status against a target population of 27,246,033. This is an indication of how far the country is from attaining herd immunity against the disease, a factor that necessitates investigation into the determinants of the acceptance of the

vaccines. Some research work carried out by Osur *et al*., (2021) found out that only 42% of Kenyans aged between 18 and 35 years were willing to get vaccinated.

Despite the Ministry of Health having received a total of 27,087,910 doses of COVID-19 vaccines as at 22nd June 2022, only 18,668,158 vaccinations had been made. This therefore implies that 8,419,752 vaccines were still not used despite being available. Additionally, only 8,611,803 adults had been fully vaccinated against a target population of 27,246,033. In accordance with these statistics, a high level of vaccine hesitancy can be noted.

Regardless of the vaccines being availed, Machakos County had fully vaccinated 314,208 individuals against a target of 905,172 as at 22nd June 2022 (34.70% of the total population in the county). This is a quite low vaccine uptake as compared with majority of the neighbouring counties which had recorded higher acceptance of the vaccine such as Nairobi (49.7%), Kiambu (35.9%), and Kirinyaga (37.7%). Despite the uptake being higher in some neighbouring counties such as Makueni (28.3%) and Kitui (17.2%), it is still quite low as compared to the percentage required for herd immunity. With these statistics being indicative of the situation in all the sub-counties across Machakos County, it was necessary to describe the extent of the problem in Mwala sub-county and find out the determinants associated with acceptance of the vaccine.

If the low vaccine uptake persists, the country may be exposed to other waves of the disease due to propagated infections. This therefore called for research to bring out the key elements likely to impact acceptance of COVID-19 vaccination services. The findings from this research report are quite informative of the vaccine uptake and its underlying determinants in Mwala Sub-county. Therefore, the insights and

recommendations brought forward in this study should be kept in consideration while coming up with strategies to encourage vaccine uptake among adults in Kenya.

1.3 Research Questions:

i. What is the level of COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya?
ii. What are the demographic factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya?
iii. What are the social factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya?
iv. What are the individual factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya?
v. What are the administrative factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya?

1.4 Study Objectives:

1.4.1 Broad Objective:

The primary goal of this research study was to assess the determinants of COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.

1.4.2 Specific Objectives**:**

i. To determine the level of COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.
ii. To identify the demographic factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.
iii. To identify the social factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.

iv. To identify the individual factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.

v. To identify the administrative factors associated with COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.

1.5 Significance of the Study**:**

The COVID-19 pandemic has so far brought about numerous deaths and deteriorated quality of life across different populations. To restore normalcy, the Kenyan government launched a vaccination campaign against the disease targeting the adult population in the bid to attain herd immunity and contain the pandemic. However, people's intentions and decisions to get vaccinated may be impacted by several aspects such as social media propaganda and conspiracy theories about the vaccine and alleged exposure to the disease. These issues may be grouped into different categories such as administrative, individual, social and demographic factors depending on their nature. In the bid to have a greater percentage of the population vaccinated and acquiring immunity against COVID-19, such factors needed to be investigated and addressed. The findings from this study are therefore of importance while designing interventions to encourage individuals to embrace COVID-19 vaccination exercise and acquire the respective services across the country. This will in turn protect the community from COVID-19 infections through herd immunity. Additionally, the discoveries made by this research study supplement the currently available knowledge about COVID-19 and the key elements that may influence vaccine uptake.

1.6 Justification of the Study:

Generally, vaccines play a quite important role in prevention of the respective diseases. In this regard, mass vaccination against COVID-19 is equally important in containing the global pandemic. This therefore calls for a haste vaccination against the disease

across the eligible population. Despite the fact that the government has secured and made available a variety of the COVID-19 vaccines, the uptake in Machakos County is still low. In this regard, poor vaccine uptake is likely to delay the desired herd immunity and consequently keep the population exposed to the disease in the event of another wave of COVID-19. This therefore called for research to find out the factors influencing taking and the intend to take up COVID-19 vaccination services amidst the adult inhabitants in the area.

1.7 Scope of the Study:

This research study was performed in Mwala Sub-county, Machakos County in Kenya. It targeted the adults that reside within the study area. The tools used for gathering data were well structured questionnaires which were self-administered to the study participants who were allowed to seek aid from the research assistants where necessary. The questionnaires sought to underscore the main influencers of COVID-19 vaccine uptake. Additionally, key informant interview guides were helped in collection of qualitative data from health administrators.

1.8 Limitation and Delimitation of the Study:

The key limitation of this study was that it targeted individuals residing within Mwala Sub-county and therefore generalization of the findings should be carried out prudently and with consideration of the accessibility and availability of the vaccines in that particular location. To overcome this limitation, the study sample was evenly distributed across all the wards within the sub-county thus acquiring a highly representative sample. Consequently, the study findings can be easily generalized to other locations with comparable healthcare infrastructure as Mwala Sub-county.

1.9 Operational Definition of Key Terms:

Collective responsibility – getting vaccinated against COVID-19 to increase the immune population and help the general population attain herd immunity against the disease. It also implies getting vaccinated in order to protect close friends and family members.

COVID-19 Vaccine hesitancy – Lack of intention to seek COVID-19 vaccination services regardless of availability of the vaccines. It also implies defecting from the vaccination program especially for the vaccines administered in two doses hence missing out on full vaccination against the disease.

Cues to action – situations that trigger and encourage individuals to take up COVID-19 vaccination services.

Determinants of COVID-19 vaccine uptake – Factors that encourage individuals to take up or fail to take COVID-19 vaccination services.

Full COVID-19 vaccination – the vaccination status acquired by individuals who have received all the COVID-19 vaccine doses recommended to grant them full immunity against the disease. In this regard, an individual is considered fully vaccinated upon receiving one dose of Janssen vaccine or at least two doses of Pfizer, Astrazeneca, Sinopharm, Moderna, and Sputnik V COVID-19 vaccines.

Healthcare administrator – Healthcare workers doing managerial roles in healthcare facilities (healthcare facility-in charge).

Risk perception – Awareness of how susceptible to COVID-19 an individual is and the severity associated with the disease.

Self-efficacy – being confident on the advantages allied to taking COVID-19 vaccine and its safety hence getting vaccinated.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction:

This section encompasses scrutiny of research work related to the topic that has been conducted in the recent past. It additionally presents a theoretical framework comparing this research study with the health belief model. The conceptual framework is also elaborated herein showing various possible interactions amongst the study variables. Further, literature has been reviewed herein as per the study objectives.

2.1 Empirical Literature:

2.1.1 COVID-19 vaccine hesitancy:

Different studies agree that vaccination is an essential strategy in the elimination of vaccine-preventable illnesses and significantly helps in reduction of mortalities attributable to many communicable diseases. In fact, WHO (2018) reports that over three million lives are saved annually through vaccination. However, vaccine hesitancy has been a key drawback in the fight against such diseases. As per MacDonald (2015), vaccine hesitancy is said to be the hold-up in getting or totally failing to get vaccinated in the face of accessibility of vaccination services.

Several studies have so far revealed hesitancy towards COVID-19 vaccines across diverse populations. Despite noting the critical role played by vaccines in disease prevention, medical students and healthcare workers are still recording notably high levels of vaccine hesitancy. For instance, Saied *et al*., (2021) noted a huge hesitation over the COVID-19 vaccine amidst students of medical courses in Egypt, a factor that posed significant threats to getting vaccinated. Some of these fears can be associated with lack of sufficient knowledge on the vaccine's effectiveness and the mild aftereffects (Saied *et al*., 2021).

Vaccine acceptance gives rise to different categories of people ranging from those that undoubtedly accept all the vaccines to those that refuse all the vaccines without any doubts. In between these two categories fall the vaccine hesitant group which is marked with partial acceptance of some vaccines and delayed acceptance of vaccines (MacDonald, 2015). These groups can be diagrammatically represented as indicated below.

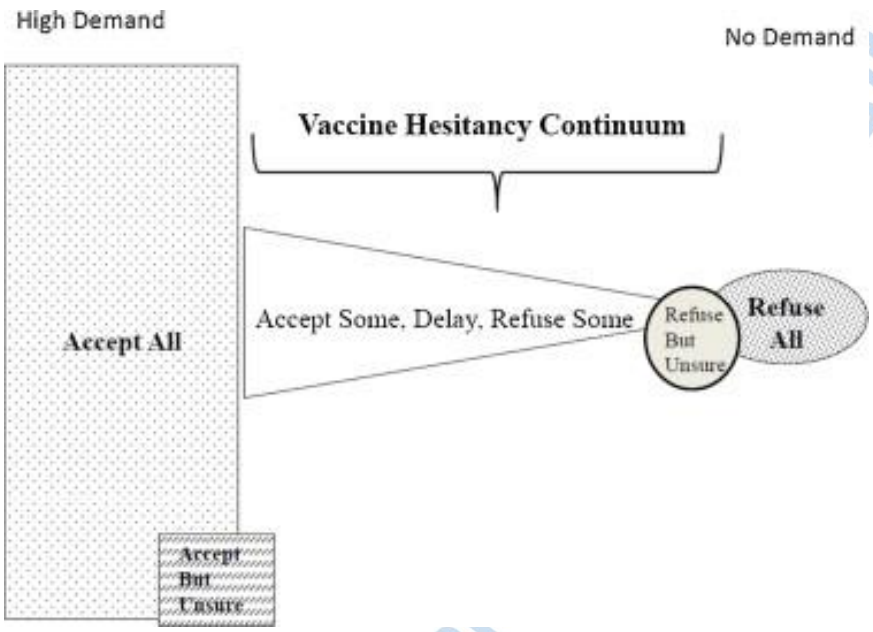

Figure 2.1: The continuum of vaccine hesitancy between full acceptance and full refusal of all vaccines (MacDonald, 2015).

Some health and administrative system failures have been often associated with vaccine hesitancy in areas with notably low uptake of vaccines. Some of these failures encompass vaccine stock-outs, few vaccination centres marked with long queues, and inaccessibility to the health facilities offering vaccination services due to conflicts and natural disasters.

Just like any other vaccine, behaviour towards and intention to seek COVID-19 vaccination services can be understood with the aid of the 5C framework on

psychological background of immunization established by Betsch *et al*., (2018). This outline is built on several constructs among them confidence which implies that having assurance in the healthcare structures and systems as well as the vaccines and human resources executing the vaccination services is likely to encourage uptake of the vaccination services (Machida *et al*., 2021). The construct of complacency on the other hand is used to explain the situation whereby some individuals hold the opinion that they are not quite vulnerable or exposed to an infection hence they do not see the need to seek vaccination services. As a construct of the model, constraints refer to the elements that may bar individuals seeking vaccination services from accessing them such as vaccine stock-outs and physical inaccessibility to those seeking the services Betsch *et al*., (2018).

Calculation on the other hand entails conducting a critical review on the vaccine to weigh out the effectiveness as compared with the associated aftereffects before getting vaccinated. In this regard, the end result could be getting vaccinated if the vaccine seems beneficial to the engaged individual or missing out on the vaccination services if the risks are overwhelming to the specific person. Therefore, calculation could lead to missed vaccination opportunities if the person involved is misinformed about the vaccine (Betsch *et al*., 2018). The last construct of collective responsibility refers to situations whereby people acquire vaccination services in the bid to safeguard their health and help keep themselves safe as well as their family members and friends from possible contagion with the disease.

2.1.2 Demographic Factors:

Several studies agree that demographic determinants affect health seeking behaviours among different categories of people. In the situation of COVID-19 vaccination, such factors are also likely to impact vaccine uptake. Several authors associate positive

health seeking behaviours with higher education levels. Additionally, higher education levels are often associated with higher vaccine literacy levels. The fact that vaccine literacy is still low in some of the developing nations is a critical drawback to the efforts channelled to attaining herd immunity across the world. This is clearly reflected by the concerns raised by individuals in these countries pertaining safety of the vaccine as well as its benefits. For instance, a research performed by Mundagowa *et al*., (2022) discovered that 76% of the eligible population in Zimbabwe still held the thought held by many people about COVID-19 vaccine lacking adequate efficiency in combating the virus and managing the pandemic. According to a study carried out by Al-Mohaithef and Padhi (2020), high literacy levels can be closely associated with high intents to take COVID-19 vaccine. Similar discoveries were published by Malik *et al*., (2020) whom upon engaging adult residents of the United States found out that individuals who had gone through college and university education levels had greater chances of embracing the COVID-19 vaccination services once the program is rolled out unlike their counterparts who recorded lower literacy levels.

Al-Mohaithef and Padhi (2020) further noted that older people had higher intentions to get vaccinated as compared with younger individuals (aOR: 2.15; 95% CI: 1.08–3.21). These discoveries are in quite harmony with those from a research study conducted by Figueiredo and Larson (2021) which associated high intentions to get vaccinated with old age and being male. Discoveries from a study by Malik *et al*., (2020) further back up this finding since it predicted a relatively better uptake of the COVID-19 vaccination services by male inhabitants of the United States of America as compared to their female counterparts. In this regard, older people have been found to be more cautious on matters pertaining their health hence seeking to practice preventive measures; among them getting vaccinated against vaccine-preventable diseases.

In their study on determinants of COVID-19 hesitancy, McElfish *et al*., (2021) associated young age and being female with high levels of vaccine hesitancy. Regarding marital status, Al-Mohaithef and Padhi (2020) found out that married people had higher chances of embracing COVID-19 vaccination services as opposed to the single, divorced, and widowed ones (aOR: 1.79; 95% CI: 1.28-2.50).

2.1.3 Social Factors:

Collective Responsibility

Among the motivating factors to get vaccinated is collective responsibility which in this context can be defined as the desire to protect self and others especially the close friends and family members. Additionally, the urge to take up COVID-19 vaccination is likely to be high among the health literate individuals who understand the need for mass vaccination during a pandemic and its role in gaining herd immunity. A study conducted by Thaker and Menon (2020) on public attitudes revolving around COVID-19 vaccines revealed this aspect of collective responsibility whereby, a great number of New Zealanders intended to acquire vaccination services with an aim of protecting themselves and their families. Additionally, the study also realised that a notably huge number of individuals were informed about herd immunity and desired to get vaccinated in the bid to protect their communities and feel safe around other people (Thaker and Menon, 2020). These findings can be further related with those from Rane *et al*., (2022) who found out lower odds for COVID-19 vaccine refusal by the adult inhabitants of the United States who were concerned about wellbeing as well as safeguarding of their close relatives and friends from COVID-19 contagion.

Social Media Misinformation

Increased reliance on incredible sources can immensely affect uptake of vaccines. This may entail getting inaccurate news on vaccines and their side effects thus leading to negative public perception and consequently low uptake of the vaccine. A study conducted by Burki (2019) on the uptake of MMR vaccine in the United Kingdom correlated social media misinformation with measles vaccine refusal. From the time when COVID-19 emerged, numerous conspiracy ideologies have been circulating in different social media platforms (Ahmad and Murad, 2020). These have been extended even to the various vaccines approved by the WHO against the disease. In their study on uptake of COVID-19 vaccination services amongst Saudi Arabian healthcare personnel, Barry *et al*., (2021) realised that increased reliance on social media sites as basic sources of facts had misinformed a notably large number of medics on the vaccine thus lowering its acceptance ($P<0.001$). A study conducted by Jeanette and Robert (2021) further pointed out conspiracy theories majorly spread via social media platforms as one of the primary negative predictors of acceptance of COVID-19 vaccination services ($F(30, 773) = 21.06$, $p < .001$, Adj. $R2 = 0.4$) The unreliable sources have been disseminating made-up messages which are incorrect concerning the vaccine especially its effectiveness and aftereffects thus misinforming the public that various COVID-19 vaccine variants are harmful to their health. This has brought about fears among both the health illiterate individuals and the healthcare workers (Loomba *et al*., 2021). As a result, the herd immunity goal remains threatened and difficult to hit before the disease causes immense damage.

Religion and Religious Teachings:

Individual health behaviours and decisions are influenced by multiple factors; among them religious teachings. Therefore, people from different religious denominations have a great likelihood of adopting diverse health behaviours ranging from seeking curative services to preventive healthcare services such as vaccination. In that regard, the impact of religious teachings on vaccine acceptance and uptake could be positive or negative. Butt *et al*., (2020) point out that religious beliefs and taboos are among the critical factors associated with poor uptake of general immunization targeting different vaccine preventable diseases. With an history of vaccine refusal and hesitancy, it will be quite difficult for communities living with religious beliefs that are against vaccine uptake to accept COVID-19 vaccines. In their review, Moola *et al*., (2021) point out the impact of religious beliefs on COVID-19 vaccination services acceptance among individuals from Low-and Middle-Income Countries (LMIC). A study conducted by Singh *et al*., (2021) further shows the impact of religion on the uptake of COVID-19 vaccine among residents of Hong Kong. In their findings, the authors highlight the negative effect of some religious teachings on overall vaccine acceptance. These discoveries concur with those from a survey carried out by Kabakama *et al*., (2022) who enlist religious beliefs as part of the factors associated with hesitancy towards COVID-19 vaccines in the sub-Saharan Africa. In summation, noble religious teachings about the vaccine are highly likely to influence acceptance of the COVID-19 vaccine positively. On the other hand, detrimental teachings from religious teachings possess a great likelihood of impacting COVID-19 vaccine acceptance negatively.

2.1.4 Individual Factors:

Confidence in Vaccines' Safety and Systems

In a study to underscore the predictors of intention to acquire COVID-19 vaccine amid Hong Kong based nurses, Kwok *et al*., (2021) contextualised the 5C framework noting that confidence encompasses conviction that the vaccine is harmless and effective enough to offer protection against the disease. They also argue that necessity of the vaccine and trust in the manufacturers further determine the intention to get vaccinated and are a critical part of the construct of confidence in the framework. This mirrors a scholarly finding by Yin *et al*., (2021) which associated Chinese people's trust in vaccine manufacturers with high intentions to get vaccinated. However, these findings contrast those from a similar study done in the US which found out that healthcare workers had safety concerns regarding the vaccine noting that the approval had been done abnormally fast (Shekhar *et al*., 2021). In this regard, the intention to get vaccinated was consequently low. This therefore implies that having manufacturers of the COVID-19 with good reputation is a key predictor to the uptake and acceptance of the latter. However, some people express fears and mistrust on the COVID-19 vaccine manufacturers as well as the process of approval of the vaccines thus making them hesitant to receiving the vaccine or fully refusing it. For instance, findings published by Aldossari *et al*., (2021) indicate that concerns raised by some of the vaccine hesitant individuals in Saudi Arabia entail haste approval and production of the vaccines as well as having few trials done to check effectiveness of the latter. Perceived side effects may however lower individuals' confidence and trust in the vaccine manufacturers; an aspect likely to bring about low uptake of the vaccines (Wong *et al*., 2020). Tran *et al*., (2021) further agree with these discoveries in their research work which found out that Russians who were more confident in their existing healthcare structures and systems

had higher odds of acquiring vaccination services against COVID-19 as contrasted with individuals who had no confidence in the latter (aOR = 2.73, 95% CI 1.76 - 4.24). A survey carried out in Kenya by Orangi *et al*., (2021) further affirmed the significance of confidence in effectiveness of the COVID-19 vaccine to its uptake. In this regard, they found out that Kenyans who expressed concerns with the effectiveness of the vaccine in prevention of the effectiveness had higher odds of failing to seek the vaccination services as compared to those who had confidence in the latter (aOR:1.42; 95% CI:1.01 – 1.98).

Risk Perception (Severity and Susceptibility)

Individuals who consider themselves as more exposed and vulnerable to acquiring COVID-19 are likely to have greater intents to take up vaccination services against the disease. Additionally, the intent to get vaccinated is more likely to increase with the fear that the disease will be more severe to an individual if he gets infected (Kwok *et al*., 2021). Therefore, people suffering from certain chronic illnesses among them diabetes have a greater likelihood of getting vaccinated due to fear of COVID-19 severity if they fell ill. Kwok *et al*., (2021) term this as weak complacency and a motivation to get vaccinated. Viswanath *et al*., (2021) noted vaccine hesitancy amidst residents of the United States which indicated their unwillingness to take up COVID-19 vaccination services. The authors further noted that risk perception (severity and susceptibility) to COVID-19 infection was a key determinant to the people's willingness to embrace the vaccination exercise and seek the service.

Basing their findings on the health belief model, Wong *et al*., (2021) noted that susceptibility and severity were among the key determinants to the embracing of COVID-19 vaccination services among residents of Hong Kong. Such discoveries are in

harmony with those from a Saudi Arabian study by Al-Mohaithef and Padhi (2020) which realised that individuals that perceived themselves as more vulnerable to the disease had greater intentions to get vaccinated against it. A similar study in the same setting specifies that healthcare workers that were working in the intensive care units and hospital set ups had significantly higher intentions to get vaccinated (Barry *et al*., 2021). A similar survey carried out on the general population in Kenya by Orangi *et al*., (2021) found out that individuals who reported as to not being exposed and susceptible to COVID-19 possessed a greater likelihood of failing to seek out to get vaccinated (aOR:1.80; 95% CI:1.54 – 2.10). In summation, people that perceive themselves as more exposed and susceptible to acquiring the infection such as healthcare workers have a greater likelihood of seeking COVID-19 vaccination services as compared with the general population.

Perceived Benefits

Generally, any health behaviour is more likely to be upheld if its presumed benefits can be understood by many individuals. This is not different from the scenario of COVID-19 vaccine as seen in many studies conducted in different contexts both demographically and geographically. According to Wong *et al*., (2020), the protective advantages associated with COVID-19 vaccines in prevention of the disease are key determinants of its acceptance (OR = 2.51, 95% CI 1.19–5.26). Individuals that hold the opinion that the vaccine is safe and important have a greater likelihood of getting vaccinated (Callaghan *et al*., 2020). This concurs with a study carried out by Davis *et* al., (2022) in six developing nations; among them Kenya which points out benefits of the COVID-19 vaccine as a key factor influencing its uptake. Therefore, a proper understanding of the protective benefits associated with COVID-19 vaccine has proved to be a motivating factor towards uptake of the vaccination services.

Safety Concerns

Several studies agree that safety concerns are among the key factors attributable to low and poor acceptance of COVID-19 vaccination services (Orangi *et al*., 2021). These worries can be attributed to all witnessed aftereffects of the vaccine among the recipients. Despite the fact that the WHO and the vaccine manufacturers have made efforts to reassure the public that the vaccine is safe, beneficial and can only have minor negative effects, many individuals still have fears towards the vaccine. For instance, Tran *et al*., (2021) realized a notably great hesitancy with the Russian population as well as lack of free will to seek or acquire COVID-19 vaccination services due to several reasons, among them fear of perceived vaccine's harms (aOR = 1.65, 95% CI 1.03 - 2.65). A survey conducted among care home staff in Liverpool found out that safety concerns regarding the vaccine were not limited to pregnancy and fertility concerns but extended to touch on allergic reactions (Tulloch *et al*., 2021). A similar study also realised safety concerns posed by Egyptian medical students who hesitated taking the vaccine in the fear of associated side effects (Saied *et al*., 2021). Among Kenyans, Orangi et al., 2021 realized that individuals who posed fears that the COVID-19 vaccine was harmful with overwhelming aftereffects had higher odds of being hesitant to seek the vaccination services as compared to their counterparts who expressed confidence in the same services (aOR:3.38; 95% CI:2.81 – 4.07).

2.1.5 Administrative Factors (Constraints):

Availability of Vaccines and Number of Vaccination Centres:

Vaccine stock-out has been associated with low immunization coverage for years now. When the vaccines are not availed in the nearest and easily accessible vaccination centres, only few individuals are likely to be vaccinated (Burnett *et al*., 2018). Over

time, low immunization coverage has been closely associated with unavailability of vaccines. For instance, Shendale *et al*., (2020) cite vaccine stock-out in healthcare facilities among the reasons for missed opportunities for immunization in Kenya. This problem can easily be encountered with COVID-19 vaccine if not mitigated early enough. However, with the continued reception of more quantities of different COVID-19 vaccines into the country as reported by the Kenyan Ministry of Health, the healthcare facilities with the capacity to stock them and maintain the cold chain could be restocked and help bring to an end the issue of availability.

Additionally, distribution of the available vaccines may be among the key factors likely to lead to low uptake of the vaccine in various parts of the country with few vaccination centres. Fisk (2021) lists distribution issues as a key barrier to vaccination in the bid to counter COVID-19. With the vaccines being availed in only a few healthcare facilities, long queues are likely to be encountered; an aspect that may be a barrier to many individuals seeking the service. Further, accessibility of the COVID-19 vaccination centres by individuals seeking the services is also a factor that may influence the vaccine uptake. For instance, Muchiri *et al*., (2022) found out that accessibility to the vaccination centres in Kenya was a barrier to individuals seeking COVID-19 vaccination services especially in the marginalised areas. It entailed measuring accessibility to the vaccination services with the aid of approximated travel time to the designated vaccination centres. Among the primary contributors of slow as well as poor endorsement of COVID-19 vaccination services is inequity in distribution of the vaccines (Perveen *et al*., 2022). With equitable distribution of vaccines, accessibility is likely to be improved thus countering possible long queues and long waiting hours in the vaccination centres.

2.2 Theoretical Framework:

This research is founded on the health belief model. This is because the constructs of this model have demonstrated a notably relevant relationship with the objectives of this study.

2.2.1 The Health Belief Model:

Since its development by US Public Health Officials; Hochbaum, Rosenstock, and Kegels in 1950s, the health belief model has proved useful in multiple instances to study and explain different health behaviours. Additionally, it has proved its adequacy in prediction of health behaviours as seen in the already conducted studies. Just like in cases of other health behaviours, the constructs of this model closely compare with COVID-19 vaccine reception behaviours among individuals (Wong *et al*., 2021). In this regard, it can help understand possible reasons as to why some individuals are prepared to seek COVID-19 vaccination services while others are not.

Among the constructs of the model is perceived susceptibility which holds that health actions of a person are determined by the perceived risk of acquiring illness (Green *et al*., 2020). In the scenario of COVID-19, a person that perceives himself as more exposed to and can easily contract the disease has a big likelihood of getting vaccinated against it. In agreement, Viswanath *et al*., (2021) hold that a greater percentage of the US adults has a bigger likelihood of acquiring COVID-19 vaccination services owing to their risk perception towards the disease. As reviewed by Wang and Liu (2022), several studies have found out that individuals who feel more exposed to infection with COVID-19 possess a comparatively larger likelihood of seeking out vaccination services against the disease.

Perceived severity is also a construct of this model which implies that uptake of behaviour is influenced by the fear of seriousness of a certain illness if an individual falls ill. According to Mantovani *et al*., (2020) COVID-19 severity is likely to be higher in individuals with pre-exiting illnesses among them diabetes and cardiovascular diseases (OR:2.10, 95% CI 1.71–2.57). In a study to forecast the motive to seek out COVID-19 immunization services, Wong *et al*., (2020) realized that Hong Kong residents who had fears of severity of COVID-19 if they fell ill had greater intents to acquire the vaccination services. As per their review on elements likely to impact reception of the COVID-19 vaccine, Wang and Liu (2022) found out that a great percentage of studies concluded that people with underlying health conditions have a higher probability of seeking the vaccination services against COVID-19 unlike their counterparts with wholesome health and zero comorbidities. However, findings of a study carried out by Omar *et al*., (2022) disagree with these discoveries as they found out low acceptance of the vaccine among diabetes patients Sudan. This could however be due to some other factors such as low vaccine literacy particularly on the benefits associated with the vaccine among high risk groups. In this regard, population groups living with certain chronic illnesses and comorbidities for example diabetes are likely to take the vaccine since they understand the severity that may come with the disease in case they fall ill.

As per the model, perceived benefits of certain health behaviour are likely to influence individual actions and conduct. In this regard, individuals that perceive COVID-19 vaccine to be beneficial in offering protection against the disease possess a greater probability of seeking out and acquiring the respective vaccination services. In their survey engaging residents of the US as well as Canada, Gerretsen *et al*., (2021) claim that lack of adequate trust in the significance of COVID-19 vaccines in offering

immunity against the disease is partially responsible for high vaccine hesitancy and poor uptake (R^2 = 0.38, F (7,7670) = 684.10, p < 0.001). Among the constructs of the model, perceived barriers encompass belief about potential negative impacts of a health action or obstacles to the performance of health behaviour (Green *et al*., 2020). In this scenario of COVID-19 vaccination, potential barriers may entail vaccine stock-outs, few vaccination centres which may lead to long queues, and lack of confidence in vaccine manufacturers.

The other key concepts of the contextualised model are self-efficacy and cues to action. Cues to action entail the factors that trigger certain health actions. For instance, individuals that ever fell ill of COVID-19 and recovered have a greater likelihood of accepting the vaccine. This theory is backed up by discoveries from a study published by Adedeji-Adenola, Olugbake, & Adeosun, (2022) which argues out that Nigerian adults who had no history of COVID-19 infection held a lesser probability of seeking the vaccination services as likened with those who had fallen sick of the disease before (aOR = 0.210 (95% CI: 0.082–0.536) P = 0.001). Similarly, those who have ever had any of their close colleagues fall ill of the disease are also more moved to get vaccinated.

On the other hand, self-efficacy entails having confidence that one can execute a certain beneficial health action. Therefore, being certain that COVID-19 vaccine is harmless, beneficial, and may not have any major side effects is likely to influence its acceptance. On the other end, having inadequate certainty in vaccine manufacturers and systems besides procedures used in clearance and listing of the COVID-19 vaccines as fit for intake can negatively impact uptake of the latter. For instance, Soares *et al*., (2021) found out that Portuguese inhabitants who expressed little to no confidence in the

existing health services and systems had higher odds of failing to embrace COVID-19 vaccination services (aOR: 7.56, 95% CI: 3.59, 15.92).

Summary of the Literature Review:

As per the reviewed research studies, it is clear that vaccine hesitancy remains one of the major obstacles to attaining full vaccine coverage against any vaccine-preventable disease. With the COVID-19 scenario, vaccine hesitancy all through to full rejection of the vaccine could hinder attainment of herd immunity against the disease hence prolonged course of the pandemic. Different studies have revealed common influencers of COVID-19 vaccine uptake which can best be categorised as individual, social, and administrative factors. Examples of such factors include perceived susceptibility, social media propaganda, and availability of the vaccines among others. From the reviewed publications, it is evident that these factors may affect the intention to get vaccinated both positively and negatively. To control the negative influence of these elements on COVID-19 vaccination drive, it requires a combination of strategies to encourage vaccination among the adults. However, this can only be developed after keen investigation of the underlying determinants of vaccination. This therefore necessitated this research which broadly sought to investigate the factors that could affect COVID-19 vaccine uptake by adults.

2.3 Conceptual Framework:

In this research study, the conceptual framework was embedded on individual, social, demographic, as well as administrative factors as the independent variables. Some of the individual factors are risk perception, confidence in vaccine manufacturers, safety concerns, and perceived benefits of the vaccine. The dependent variable is COVID-19 vaccine uptake which entails likelihood of getting vaccinated or not while the assumed

intervening variable is religion. The interaction between these variables can be diagrammatically represented as revealed in Figure 2.2 below.

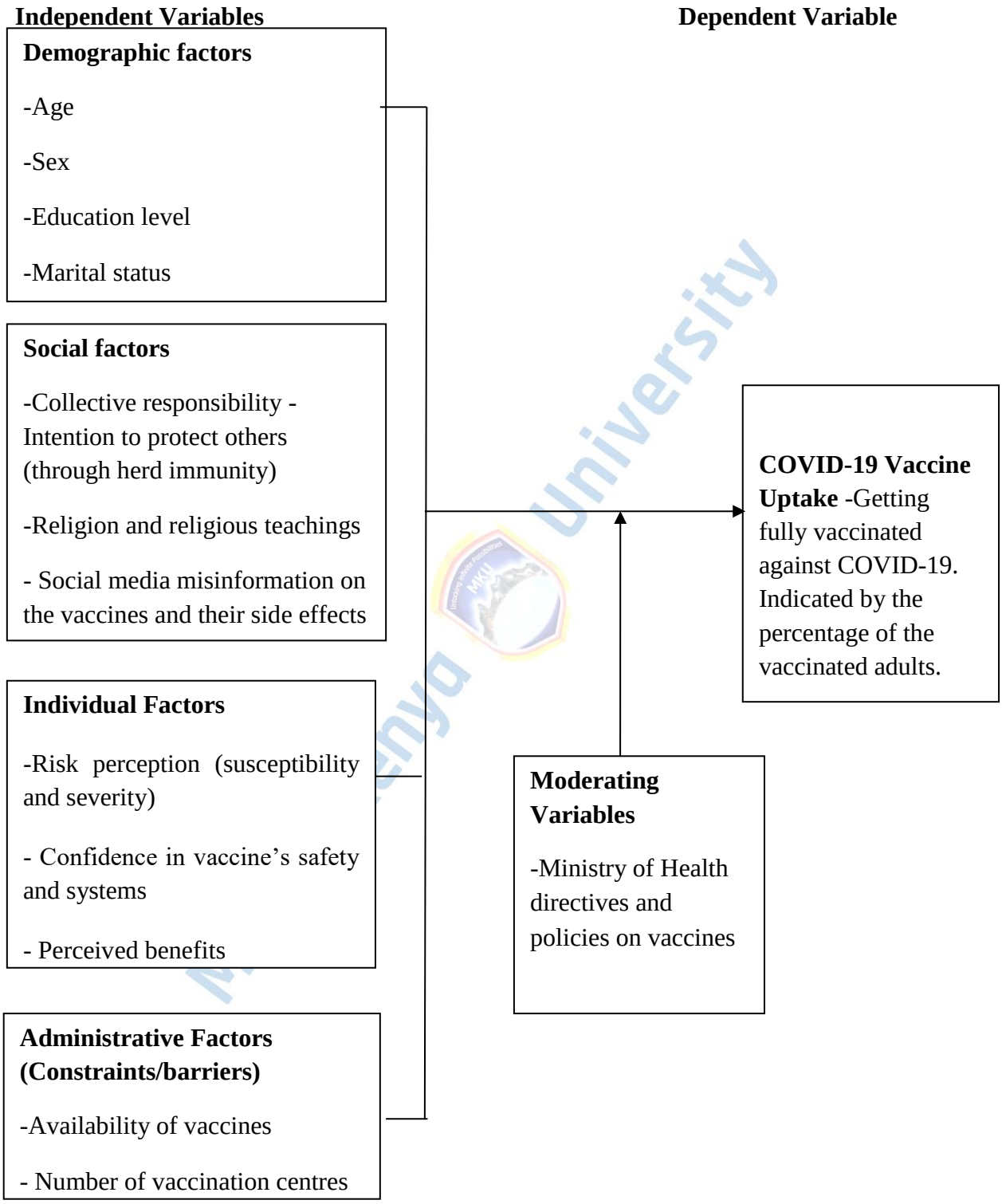

Figure 2.2: Conceptual framework for the hypothesised determinants of COVID-19 vaccine uptake.

CHAPTER THREE: METHODOLOGY

3.0 Introduction:

The methodologies applied herein are expounded in this section. In that regard, this bit brings into context the used research study design, location of the study, sampling procedures and techniques, target population, study sample and sample size, data collection approaches, data management, analysis as well as presentation methods, study eligibility criteria, and research approval and ethical considerations for the study.

3.1 Study Design:

This research study applied an analytical cross-sectional study design. A mixed method approach comprising of both qualitative and quantitative methods was used. The design endorsed the investigation of the elements likely to affect COVID-19 vaccine uptake by adults in Mwala Sub-county, Machakos County, Kenya, once without influencing the behavior of the study participants in any way. This study design was preferred since it allowed data collection at once in time and the establishment of the statistical relationship between the conceptualized study variables.

3.2 Study Variables:

3.2.1 Dependent Variable:

This study has one outcome variable which is COVID-19 vaccine uptake. In this regard, full COVID-19 vaccination was defined as the vaccination status acquired by individuals who have received all the COVID-19 vaccine doses recommended to grant them full immunity against the disease. Therefore, an individual was considered fully vaccinated upon receiving one dose of Janssen vaccine or at least two doses of Pfizer, Astrazeneca, Sinopharm, Moderna, and Sputnik V COVID-19 vaccines.

3.2.2 Independent Variables:

The explanatory variables are grouped into three different categories based on their nature. Among these are the individual factors which entail risk perception, perceived vaccine benefits, confidence in vaccine's safety and systems, and vaccine safety concerns. Additionally, the study also addressed social and demographic factors whereby the social factors entail religion (impact of religious teachings on vaccine uptake), social media misinformation on vaccines' safety and side effects, and collective responsibility as a factor encouraging vaccination. The demographic elements encompass age, sex, marital status, and education level. Administrative factors on the other hand entailed availability of vaccines and number of vaccination centers.

3.2.3 Moderating Variable:

The study also took into consideration the moderating variable which might interfere with the connection between the response variable and the predictor variables. This entailed Ministry of Health policies on COVID-19 vaccination.

3.3 Location of the Study:

This study was carried out in Mwala Sub-county, Machakos County, Kenya. The map of this location is shown in Appendix II. The Sub-county's coordinates are latitudes 0.45'S and 1.31'S and longitudes 36.45'E and 37.45'E. As per the KNBS (2019), the Sub-county comprises of six wards and a total population of 181,896. This makes it the second most populous Sub-county in Machakos after Athi River. The high population in this area makes it suitable for the study since in case of an outbreak, a great population can be adversely affected. Mwala Sub-county has six healthcare facilities offering COVID-19 vaccination services namely Mwala level four hospital and Wamunyu, Mbiuni, Masii, Katulani, and Muthetheni health centres.

3.4 Target Population:

This research targeted individuals above the age of 18 years residing within Mwala Sub-county. This population group was of interest to this study because it is the key target of the COVID-19 vaccination campaign.

3.5 Sampling Technique and Procedure:

For this study, Machakos County was purposively sampled due to its low vaccination rates against COVID-19 as noted recently. In this regard, Machakos County had fully vaccinated only 314,208 adults as at 22nd June 2022, a quite small proportion of the total population. Mwala Sub-county was also purposively sampled since it is among the highly populous sub-counties in Machakos. The sample was drawn from the six wards within the sub-county whereby, selection was done from people visiting healthcare facilities within the area. Systematic random sampling was conducted to settle on the questionnaire respondents among the people visiting Mwala level 4 hospital, Wamunyu, Masii, Katulani, Muthetheni, and Mbiuni health centres. Additionally, health administrators from the six vaccination centers were engaged in the key informant interviews. The partakers of the Key Informant Interviews (KII) were selectively sampled from the six health care facilities that were used for data collection. In this regard, the healthcare administrators were sampled for the interviews.

3.6 Eligibility Criteria:

3.6.1 Inclusion Criteria:

The study engaged participants that were adult residents of Mwala sub-county and gave out their consent to respond to questions pertaining study. In context of this study, adult individuals are people who have at least attained the age of 18 years. On the other hand, residents of Mwala Sub-county are the individuals who permanently live within the constituency of Mwala.

3.6.2 Exclusion Criteria:

The study left out individuals who were not residents of Mwala sub-county regardless of their location during the time which data was being collected. Individuals below the age of 18 years were also not engaged to respond to this study. Additionally, all individuals that failed to consent to take part in the study were also not engaged.

3.7 Study Sample and Sample Size:

Cochran's formula for determination of sample size from an infinite population was used as indicated below.

$$n = \frac{z^2\, pq}{e^2}$$

Whereby;

n = sample size

z = the critical value of the used confidence level (in this study, a z value of 1.96 was used since the confidence level was 95%)

p = estimated percentage of an aspect existent in the population (in this study, maximum variability of 50% was used)

q = 1 – p

e = confidence interval/ margin of error (in this study, 0.05 level of precision was used since the confidence level was set at 95%)

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384$$

The research study therefore engaged 384 participants whereby 64 respondents from each of the six selected healthcare facilities were engaged.

3.8 Data Collection Methods and Tools:

This study made use of structured questionnaires (Appendix III) in gathering quantitative data as given by the respondents. During the process, anonymity of the respondents was maintained. Additionally, key informant interview guides (Appendix IV) helped in collection of qualitative data from health administrators in the six COVID-19 vaccination facilities in Mwala Sub-county. These facilities include Mwala level 4 hospital, Masii, Wamunyu, Katulani, Mbiuni, and Muthetheni health centres.

The data on level of vaccine uptake was pulled together through the aid of the semi-structured questionnaire in Appendix III section B whereby information on vaccination status of the respondents was gathered. Data on individual factors was gathered through the help of the semi-structured questionnaire in Appendix III section C. This information was compared with respondents' COVID-19 vaccination status.

Demographic data of the respondents on the other hand was also gathered by means of the semi-structured questionnaire Appendix III section A and compared with vaccine uptake information captured in section B of the same tool. Information on social factors was collected under section C of the same questionnaire and further compared with data from section B. Information on administrative factors was collected using the semi-structured questionnaire Appendix III section D. To establish the statistical significance between these factors and vaccine uptake, analysis was done to compare the data with information captured in section B of the same tool.

3.9 Testing of Validity and Reliability:

3.9.1 Testing of Validity:

Validity of the research tool was achieved by ensuring that contents of the questionnaire are objective and matched with the aims of the study hence, face validity was achieved. Additionally, keeping all questions in the questionnaire relevant to the topic of the study further helped in achieving construct validity. Validity was further assessed with the aid from the supervisors who ascertained the relevance of the research tool for this study prior to collection of the data.

3.9.2 Testing of Reliability:

The reliability of the questionnaire was ascertained with the aid of the SPSS software version 26 using the internal consistency method. In this regard, the Cronbach's alpha coefficient was generated for the constructs of the research questionnaire. The Cronbach's alpha value was generated for each category of factors as well as the vaccine uptake section separately. All these sections had Cronbach's alpha values above the threshold of 0.7 and consequently the questionnaire was considered reliable. These findings are indicated in table 3.1 below.

Table 3.1 Questionnaire reliability test results

Section	Cronbach's Alpha Value	Number of Items
Level of COVID-19 vaccine uptake	0.826	5
Social and demographic factors	0.753	8
Individual factors	0.797	7
Administrative factors	0.934	3

3.10 Data Management, Analysis, and Presentation:

After collection, the data was coded and moved into the SPSS software version 26 where it was safely stored and analysed. The analysis entailed both descriptive and inferential statistics. In this regard, the descriptive findings allowed display and description of the study participants. Frequencies and percentages helped in description of the socio-demographic findings about participants of this study. Additionally, these descriptive statistics were used to describe the COVID-19 vaccination status in addition to vaccine acceptance status of the respondents. In this respect, percentages and frequencies were used. Additionally, univariate analysis entailing means as well as standard deviations aided in analysis of data on Likert scale. Binomial logistic regression analysis was done at significance level $p = 0.05$ to check for statistical significance between some explanatory variables and the response variable which is vaccine uptake in this regard. Additionally, Chi-square test of association aided in establishing any statistically significant association among categorical variables in this research study. Qualitative data that was gathered from key informants supplemented the study findings. The qualitative data was analysed using the narrative analysis method. In this regard, verbatim quotes from the key informants were used in reporting of the findings. Data presentation was then done with the aid of tables and bar graphs.

3.11 Research Approval and Ethical Consideration:

This research study was conducted with approval and permission from the school of public health, Mount Kenya University. The Mount Kenya University Ethics Review Committee further issued ethical clearance before the research license was received from National Commission for Science and Technology (NACOSTI). An introductory dispatch from Mount Kenya University was issued to the health administrators in the respective healthcare facilities within the study area in search for the authority to carry

out the study within the latter. Informed consent was first sought from everyone that responded to this study before administering the questionnaires or recording their responses. In this regard, the study respondents were enlightened about the research process and purpose before being engaged in the process. The research participants were free to withdraw from the research process in the event that they experience any discomfort with the process. To maintain anonymity of the participants, no identification details were written on the questionnaires. The collected information was kept confidential and only applied in this research study.

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.0 Introduction:

This chapter entails presentation, interpretation, in addition to discussion of the research results. The data was gathered between July and September 2022 in Mwala Sub-county from 384 respondents and six key informants. It additionally encompasses discussion of individual research objective results. A 100% response rate was recorded.

4.1 Research Presentation and Interpretation:

4.1.1 Socio-demographic Characteristics of the Respondents:

From the 384 study participants, 231 (60.20%) were male while 153 (39.80%) were female. The age category ranging between 18 and 34 years had majority of the respondents (171) recording a 44.50% of the whole group while that between 35 and 50 years had 110 participants (28.60%). Those between 51 and 65 years were 45 (11.70%) while the group above 65 years of age comprised of 58 respondents, 15.10% of the whole group. The study engaged 304 Christians (79.20%), 54 Muslims (14.10%), and 26 Hindus (6.80%). Regarding the level of education, 100 respondents (26.00%) had not completed any school while 69 (18.00%) had attended up to the primary school level. Whilst those who had attended up to secondary school level were 107 (27.90%), the study respondents who had attained the tertiary level of education comprised of the majority with 108 individuals (28.10%). 139 (36.20%) respondents were single, 191 (49.70%) married, and 16 (4.20%) divorced. On the other hand, only 38 respondents were separated, comprising 9.90% of all the whole group as illustrated in table 4.2 below.

Table 4.2 Socio-demographic attributes of the population

Variable		Frequency	Percentage (%)
Gender	Male	231	60.20
	Female	153	39.80
Age group	18 – 34	171	44.50
	35 – 50	110	28.60
	51 – 65	45	11.70
	Above 65	58	15.10
Religion	Christianity	304	79.20
	Muslim	54	14.10
	Hindu	26	6.80
Level of education	No school completed	100	26.00
	Primary	69	18.00
	Secondary	107	27.90
	Tertiary	108	28.10
Marital status	Single	139	36.20
	Married	191	49.70
	Divorced	16	4.20
	Separated	38	9.90

4.1.2 Level of uptake of the COVID-19 Vaccine by the Respondents:

The research study pursued to know about uptake of the COVID-19 vaccine by the engaged participants before determining the underlying determinants. In this regard, only 179 participants (46.60%) had started the vaccination program. The remaining 205 respondents (53.40%) had not enrolled for a COVID-19 vaccination schedule as indicated in table 4.3 below. When asked about any set targets on the vaccination exercise, one of the key informants said, "*We are working towards having at least 70% of the eligible population getting fully vaccinated in order to help achieve the set national target".* Another one responded, "*With some ministries directing all their employees to get vaccinated, it's our concern to ensure that such targeted population gets the necessary service*".

Table 4.3 Participants who had started off the vaccination schedule

	Frequency	**Percentage (%)**
Yes	179	46.60
No	205	53.40
Total	384	100.00

From the collected data, it was established that not all respondents who had sought vaccination services were fully vaccinated. It found out that only 45 respondents (11.70%) were fully vaccinated. On the other hand, 339 (88.30%) participants had not been fully vaccinated as shown in table 4.4 below. This pointed out a quite low vaccine uptake among the respondents.

Table 4.4 Respondents who were fully vaccinated

	Frequency	Percentage (%)
Yes	45	11.70
No	339	88.30
Total	384	100.00

The research study further pursued to establish the willingness to get vaccinated among the study participants, particularly those who had not enrolled for the vaccination program. It found out that 6.30% (24) were intending to get vaccinated, 46.60% (179) were already vaccinated, and 47.14% (181) had no intentions to get vaccinated as pointed out in figure 4.3 below.

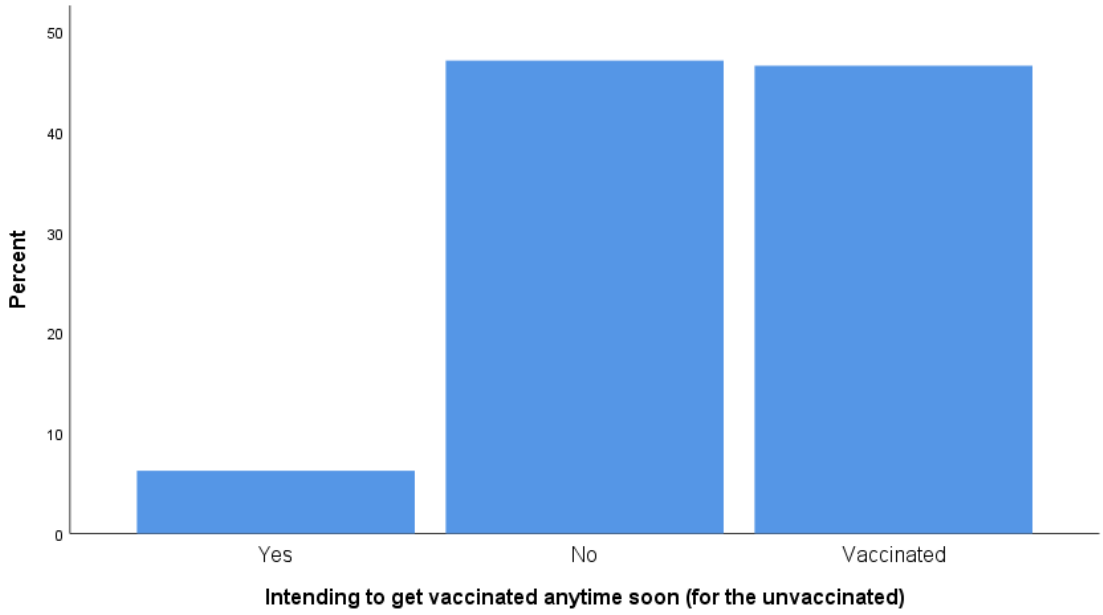

Figure 4.3 Individuals intending to get vaccinated

According to the study, the intention to get fully vaccinated was also notably low with 20.30% (78) of the participants only willing to seek full vaccination services against the disease. 11.70% (45) of the respondents were already fully vaccinated and 68.00%

(261) of the respondents were not intending to get fully vaccinated. These discoveries are publicized in table 4.5.

Table 4.5 Participants intending to get fully vaccinated

	Frequency	Percentage (%)
Yes	78	20.30
No	261	68.00
Fully vaccinated	45	11.70
Total	384	100.00

The study also targeted to establish reasons behind falling out of the vaccination program since not all individuals were willing to finish up with their vaccination schedules as recommended. It found out that only 19.53% (75) were willing to get fully vaccinated, 47.66% (183) unvaccinated and 11.98% (46) were fully vaccinated. The main reason cited for falling out of the vaccination program was the argument that the first dose was enough to offer immunity against COVID-19 by 14.06% of the respondents (54). The other 6.77% (26) failed to complete their vaccination schedule citing side effects of the first dose as indicated in figure 4.4 below.

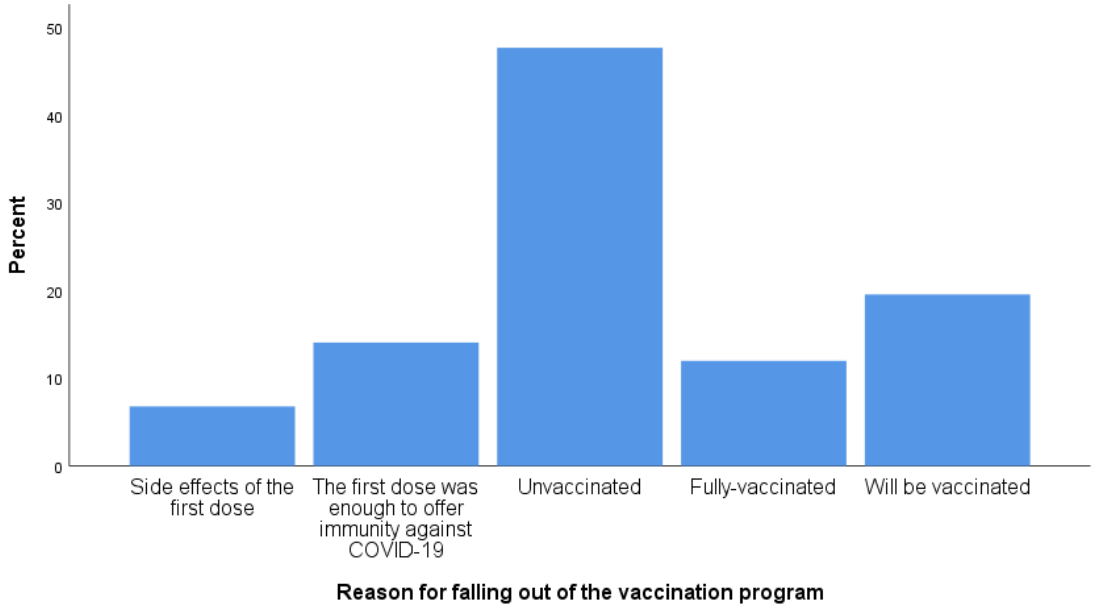

Figure 4.4 Reasons for falling out of the vaccination program

As per the findings, COVID-19 vaccine uptake was generally low. This could be noted from the fact that the majority (53.40%) had not received any dose against the disease. Additionally, among the 46.60% who were vaccinated only 11.70% were fully vaccinated. From the category of the individuals who had not received any dose, only 6.30% were intending to seek the services. In this regard, a great level of total vaccine refusal was realized. Further, only 20.30% of all the respondents were ready to acquire full vaccination in the bid to counter COVID-19. This clearly denotes how people are hesitant to acquiring COVID-19 vaccination. The key explanations cited for drop-out of the vaccination schedules by the partially vaccinated respondents entailed the perception that the first dose was enough to offer the desired immunity (14.06%) and side effects of the first dose (6.77%). In summation, these findings are indicative of notably low COVID-19 vaccine uptake noted amongst inhabitants of Mwala Sub-county.

4.1.3 Statistical Relationship Between Demographic Characteristics of the Respondents and COVID-19 Vaccine Uptake:

Out of the 231 male respondents, only 20 were fully vaccinated. On the other hand, 25 female respondents were fully vaccinated. Cross tabulation findings indicated a significant association between gender and COVID-19 vaccine uptake ($\chi^2 = 5.250$, df = 1, P = 0.022).

Only 13 respondents aged between 18 and 34 years were fully vaccinated. Additionally, 22 respondents aged between 35 and 50 years were fully vaccinated while the 51 – 65 age group had only eight respondents attaining full vaccination against COVID-19. Only two respondents aged above 65 years were fully vaccinated. These findings were further cross-tabulated to check statistical significance between age group of the study participants and their COVID-19 vaccination status. As illustrated in table 4.5 below, a statistically significant association between age of the participants and COVID-19 vaccine uptake was established ($\chi^2 = 15.524$, df = 3, P = 0.001).

Majority of the respondents who were fully vaccinated were educated up to the tertiary level of education (42). From the category of the study participants who were educated up to the secondary level, only one participant was fully vaccinated. On the other hand, two participants who had completed the primary level of education were fully vaccinated. No respondent was fully vaccinated among those who had not completed any level of education. Upon carrying out cross-tabulations, a significant association between the education level of study participants and COVID-19 vaccine uptake was realized ($\chi^2 = 107.556$, df = 3, P < 0.001) as publicized in table 4.5 below.

Upon comparing marital status of the respondents with their vaccination status, it was found out that only three single people were fully vaccinated. Married respondents

comprised the majority of the fully vaccinated with a record of 41 participants. On the other hand, only one respondent from the category of the divorced was fully vaccinated while none of the separated individuals had taken full vaccination status against COVID-19 yet. Additionally, cross-tabulations were done whereby, a significant association was ascertained between marital status of the study partakers and their COVID-19 vaccination status ($\chi^2 = 35.328$, df = 3, P < 0.001) as illustrated in table 4.6 below.

Table 4.6 Statistical relationship between demographic characteristics of the respondents and COVID-19 vaccine uptake

Variable	χ^2 Value	df	P Value
Gender	5.250	1	0.022
Age	15.524	3	0.001
Level of education	107.556	3	<0.001
Marital status	35.328	3	<0.001

4.1.4 Statistical Relationship Between Social Characteristics of the Respondents and COVID-19 Vaccine Uptake:

The study found out that 81.25% (312) of the respondents had their religious teachings supporting the COVID-19 vaccination exercise. On the contrary, the other 18.75% (72) had their religious teachings opposing COVID-19 vaccination. Further, Chi-square test of association helped check for statistical significance between religious teachings and COVID-19 vaccine uptake. In this regard, a statistically significant association between religious teachings and COVID-19 vaccine uptake was noted ($\chi^2 = 11.763$, df = 1, p = 0.001).

Regarding the respondents' main source of facts pertaining COVID-19 vaccine and their uptake of the latter, 30 participants who relied on mainstream broadcast were fully

vaccinated. Only three respondents who relied on mainstream print and 12 on verified websites were fully vaccinated. On the other hand, none of the participants who cited social media sites as their most important sources of evidence were fully vaccinated. A statistically significant association between source of information pertaining COVID-19 vaccination and vaccine uptake was noted ($\chi^2 = 32.904$, df = 3, $P < 0.001$).

A greater percentage of the study participants disagreed with the concept of getting vaccinated to protect those close to them against COVID-19 infection (Mean = 2.8594, Standard Deviation = 1.07476; strongly agree = 1, agree = 2, disagree = 3, strongly disagree = 4). In this regard, 159 (41.40%) strongly disagreed while 51 (13.28%) disagreed with this statement. On the other hand, 135 (35.16%) respondents agreed and 39 (10.16%) strongly agreed with this fact. Further, a significant association was realized from cross-tabulations between respondents' views on intention to get vaccinated in the bid to protect others against COVID-19 and vaccine uptake ($\chi^2 = 292.931$, df = 3, $P<0.001$).

Table 4.7 Statistical relationship between social characteristics of the respondents and COVID-19 vaccine uptake

Variable	χ^2 Value	df	P Value
Religious teachings on COVID-19 vaccine	11.763	1	0.001
Source of information about COVID-19 vaccine	32.904	3	<0.001
Collective responsibility (getting vaccinated to protect others)	292.931	3	<0.001

4.1.5 Statistical Relationship Between Individual Factors of the Respondents and COVID-19 Vaccine Uptake:

Among the 384 respondents, only 36 (9.38%) perceived themselves as highly susceptible to COVID-19 infection. A number of reasons were cited to explain the perception of less susceptibility towards the disease. For instance, 182 (47.40%) respondents claimed that they were not healthcare workers while 108 (28.13%) of them argued out that they adhered to the prevention guidelines hence less susceptible to the disease. On the other hand, 58 (15.10%) said that they were rarely attending public gatherings hence not very susceptible to COVID-19. Further cross-tabulations indicated a statistically significant association between respondents' susceptibility perception towards COVID-19 and vaccine uptake ($\chi^2 = 189.471$, df = 1, $p < 0.001$).

Regarding severity posed by COVID-19 infection, majority of the respondents disagreed to getting vaccinated in the bid to prevent the disease from being severe on them in the event they got ill (Mean = 2.8906, Standard Deviation = 1.05638; strongly agree = 1, agree = 2, disagree = 3, strongly disagree = 4). Going by the specific cases, only 34 (8.90%) strongly agreed and 135 (35.20%) agreed to getting vaccinated to counter the risk of potential severity posed by the disease. On the other hand, 54 (14.10%) respondents disagreed while 161 (41.90%) strongly disagreed with this claim. A cross-tabulation was conducted and indicated a significant association between COVID-19 severity perception and respondents' vaccine uptake ($\chi^2 = 234.515$, df = 3, $P < 0.001$).

A greater proportion of the study participants disagreed with the argument that COVID -19 vaccine is safe and lacks major side effects (Mean = 2.9635, Standard Deviation = 1.06142; strongly agree = 1, agree = 2, disagree = 3, strongly disagree = 4). Only 39 (10.20%) strongly agreed and 106 (27.60%) agreed to this statement. On the other hand,

69 (18.00%) participants disagreed and 170 (44.30%) strongly disagreed with this statement. On the contrary, the key interview informants agreed unanimously that the vaccine is safe and despite the mild short term side effects. One of the key informants said, "*the healthcare workers may all agree on safety of the vaccine due to their health literacy levels but the public majority may hold a different opinion on the same due to propaganda and the many conspiracy theories revolving around the vaccine*". The key informants added that conspiracy theories emanating from social media propaganda about the vaccine were a key barrier to uptake of the latter especially among the younger generation. They further noted that they have been occasionally conducting awareness campaigns to heighten the public's understanding of vaccine safety and benefits. A statistically significant association was further noted between perception towards COVID-19 vaccine safety and vaccine uptake of the respondents ($\chi^2 = 277.624$, df = 3, $P < 0.001$).

A better portion of the study participants disagreed with the argument that benefits of COVID-19 vaccine outdo the associated aftereffects (Mean = 2.9635, Standard Deviation = 1.06142; strongly agree = 1, agree = 2, disagree = 3, strongly disagree = 4). Strong agreement with this statement was however noted among 39 (10.20%) respondents. 106 (27.60%) participants agreed while 69 (18.00%) disagreed with this fact. On the other end, 170 (44.30%) study participants strongly disagreed with the fact that benefits of the vaccine outdid the side effects. On the other hand, the key informants argued out that the vaccine was effective and its benefits outdid and were incomparable with the few mild side effects. A statistically significant association was further noted between perception towards benefits of the vaccine outdoing the associated aftereffects and COVID-19 vaccine uptake after a cross-tabulation ($\chi^2 = 277.624$, df = 3, $P < 0.001$). These discoveries are publicized in table 4.8 below.

Table 4.8 Statistical relationship between individual characteristics of the respondents and COVID-19 vaccine uptake

Variable	χ^2 Value	df	P Value
Susceptibility perception towards COVID-19 infection	189.471	1	<0.001
Perceived severity from COVID-19 infection	234.515	3	<0.001
Safety concerns towards COVID-19 vaccine	277.624	3	<0.001
Understanding of COVID-19 vaccine benefits	277.624	3	<0.001

4.1.6 Statistical Relationship Between Administrative Factors and Respondents' COVID-19 Vaccine Uptake:

A larger proportion of the respondents was able to access COVID-19 vaccines in the nearby and accessible healthcare facilities. This entailed 317 (82.55%) respondents. On the other hand, only 67 (17.45%) participants were affected by vaccine stock-outs in the accessible healthcare facilities. This was further backed up by the key interview informants who universally agreed that vaccine stock-outs was no longer a barrier to the people seeking vaccination services. One of them retorted, "*Vaccine stock-outs is a problem of the past which was encountered at the beginning of the exercise and we actually have a variety of doses across the vaccination centers"*. When asked about informing the public about availability of the various doses one of the key informants said, "*In the event of stock-outs of specific types of COVID-19 vaccines, we usually inform the individuals seeking the services about the available doses through a poster as you have seen at our triage". "We additionally advise the client about the available*

options and their compatibility with the already received dose in order to reduce the drop-out rates," she added.

To check the statistical relationship between the influence of vaccine stock-outs in the respondents' accessible healthcare amenities on vaccine uptake, a binomial logistic regression analysis was carried out. In this regard, no statistically significant association was realized (OR = 0.86, 95% CI 0.82 – 0.90).

Majority of the respondents were not affected by long queues in the vaccination centers. This accounted for 88.02% (338) of the study participants. On the contrary, 46 (11.98%) reported long queues as a barrier to their vaccination. The key informants further agreed that with the increased supply of vaccines, there were no long queues encountered in the vaccination centers. One of them said, "*With the equitable distribution of COVID-19 vaccines across the Sub County, accessibility has increased hence countering the possibility of long queues in the vaccination centers"*.

Binomial logistic regression analysis was conducted to check for statistical relationship between long queues in the vaccination centers as a barrier to get the respective services and vaccine uptake among the respondents. The model did not find any statistically significant association between these two variables (OR = 0.87, CI 95% 0.83 – 0.90). These discoveries are publicized in table 4.9 as follows.

Table 4.9 Statistical relationship between administrative characteristics of the respondents and COVID-19 vaccine uptake

Variable	P Value	OR (CI 95%)
Vaccine stock-outs in the accessible vaccination centers	0.997	0.86, (0.82 – 0.90)
Long queues in the nearby vaccination centres	0.997	0.87, (0.83 – 0.90)

4.2 Discussions:

4.2.1 Demographic Factors:

Despite the study engaging more male participants, majority of the respondents who were fully vaccinated were female (6.51%). A significant association was further drawn between gender and COVID-19 vaccine uptake (χ^2 = 5.250, df = 1, P = 0.022). These findings hence indicate that an individual's gender could influence their COVID-19 vaccine uptake. This supports findings published by Diesel *et al*., (2021) which realized a higher COVID-19 vaccine uptake in female adults as compared to their male counterparts. However, these findings are in contrast with those from a publication by Malik *et al*., (2020) which predicted a slightly higher acceptance rate of the COVID-19 vaccination services amidst male adult inhabitants of the United States of America as compared to the female residents. This is also revealed in findings from research performed by McElfish *et al*., (2021) which associated female inhabitants of Arkansas with greater levels of COVID-19 hesitancy as compared with the male residents. Evidence by Mou *et al*., (2022) suggests that males have poor health seeking behaviors as compared to females and therefore this could explain the low vaccine uptake recorded among men as contrasted to the women in this context.

The data confirmed that a greater proportion of the study respondents who were fully vaccinated were aged between 35 and 50 years (22). A Chi-square test between age and uptake of the COVID-19 vaccine further indicated a significant association (χ^2 =15.524, df = 3, P = 0.001). Thus age can be considered as one of the factors likely to influence COVID-19 vaccine uptake. These discoveries align with those from a study by Fadhel, (2021) engaging Saudi Arabian residents which also indicates higher COVID-19 vaccine acceptance rates among the older individuals. Robertson *et al*., (2021) further

agree with such inferences through their research which associated young age with higher COVID-19 vaccine refusal rates.

Regarding the education level, a greater percentage of the fully vaccinated study respondents were educated up to the tertiary level (10.94%). The relationship between education level of the respondents and COVID-19 vaccine uptake was statistically significant (χ^2 = 107.556, df = 3, P < 0.001). This therefore proves that the level of education is a major determinant of acceptance of COVID-19 vaccination services. A similar study by Al-Mohaithef and Padhi (2020) also associated high literacy levels with higher intentions to seek COVID-19 vaccination services. This finding could be due to the health awareness and understanding possessed by individuals in higher literacy levels particularly on matters pertaining the role played by vaccine in prevention of diseases.

A greater proportion of the study participants who were fully vaccinated were married (41). A cross-tabulation further proved a statistically significant relationship between marital status of the respondents and COVID-19 vaccine uptake (χ^2 = 35.328, df = 3, P < 0.001). This therefore implies that an individual's uptake of the vaccine could be determined by whether he or she is married, single, separated, or divorced. These findings are in agreement with Al-Mohaithef and Padhi (2020) who realized that married people had higher intentions to get vaccinated as compared to the others. Findings by Wang *et al.,* (2020) further agree with this study since they indicate a higher likelihood of seeking COVID-19 vaccination services (OR:1.70, 95% CI: 1.26–2.29) by married residents of China as compared with the unmarried individuals.

4.2.2 Social Factors:

Despite the low COVID-19 vaccine uptake, majority of the participants (81.25%) had their religion advocating for vaccination. Therefore, a Chi-square test of association was conducted and no significant association was noted between religious teachings and vaccine uptake ((χ^2 = 11.763, df = 1, p = 0.001)). These findings agree with those brought forth by the study by Sumerlin *et al*., (2022) which indicates a relationship between religion and uptake of COVID-19 vaccination services among Hong Kong nationals. Therefore, this confirmed that COVID-19 vaccine uptake is highly influenced by religious teachings and beliefs.

Regarding source of information pertaining COVID-19 and its vaccine, a greater proportion of the fully vaccinated participants (7.81%) were relying on mainstream broadcast (television and radio). A cross-tabulation confirmed a significant relationship between the main source of information about COVID-19 and its vaccine and vaccine uptake (χ^2 = 32.904, df = 3, P < 0.001). This therefore implies that vaccine uptake could be highly dependent on an individual's main source of information. This could be the case considering the fact that none of the respondents who were depending on social media as a key provider of facts pertaining the vaccine had been fully vaccinated yet. These discoveries are in line with those from a survey done by Barry *et al*., (2021) which realized the contribution of social media misinformation to low COVID-19 vaccine acceptance from Saudi Arabian healthcare personnel. In their study which engaged inhabitants of the UK as well as the US, Loomba *et al*., (2021) further agree on the undesirable influence of misinformation on the aim to acquire COVID-19 vaccination services. These discoveries align with the findings from a study carried out by McAndrew and Allington (2020) which predicted low intent to seek out and acquire COVID-19 vaccination services amid individuals from the United Kingdom and the

United States who relied on erratic sources of evidence regarding COVID-19 updates. Jennings *et al*., (2022) further point out that the mistrust on COVID-19 vaccine and the healthcare systems and structures brought about by conspiracy theories spread through social media has a significant contribution to the vaccine hesitancy.

Regarding the aspect of collective responsibility, majority of the respondents disagreed to getting vaccinated in order to protect those close to them entailing family and friends (Mean = 2.8594, SD = 1.07476). In fact, a greater proportion of the participants (41.41%) strongly disagreed with this statement. A statistically significant relationship was noted between the intention to seek vaccination services in the bid to protect others and the respondents' vaccine uptake ($\chi^2 = 292.931$, df = 3, $P < 0.001$. It can therefore be summed up that COVID-19 vaccine uptake is likely to be impacted by the need to protect others encompassing friends and family. These results agree with a study by Thaker and Menon (2020) which found out that majority of New Zealanders were willing to get vaccinated to protect not only themselves but also their families. Rane *et al*., (2022) further backs up these discoveries with their study on vaccine refusal which noted lower odds of refusing to acquire COVID-19 vaccination services among residents of the United States who were concerned about wellbeing and protection of those close to them from COVID-19 infection. In their review of studies pertaining acceptance rates of COVID-19 vaccination services, Wang and Liu (2022) point out that majority of the studies also agree that higher intentions to seek the services were noted with individuals whose close friends and family members had an history of the infection and hence needed protection against re-infection with the disease.

4.2.3 Individual Factors:

Among the individual factors was risk perception towards COVID-19 which entailed perceptions on susceptibility and severity towards the disease. In this respect only a few

(9.38%) respondents perceived themselves as highly susceptible. A statistically significant association was further noted between susceptibility perception towards COVID-19 and vaccine uptake (χ^2 = 189.471, df = 1, p < 0.001). This therefore indicates that susceptibility perception could influence COVID-19 vaccine uptake amongst the participants. Similar findings were published by Al-Mohaithef and Padhi (2020) whereby they noted that people who perceived themselves as being more vulnerable to COVID-19 had higher intentions of getting vaccinated as compared with the rest of the population. These discoveries are further supported by those from a publication by Gerretsen *et al*., (2021) which indicated that individuals from the United States and Canada who perceived themselves as less susceptible to COVID-19 infection had higher vaccine hesitancy as likened with those who felt more susceptible to the disease (P < 0.001). In this regard, people working in the healthcare sector are more likely to seek the COVID-19 vaccination services owing to the high levels of exposure at their workplaces.

Majority of the participants disagreed on getting vaccinated to counter the severe effects posed by COVID-19 infection (Mean = 2.8906, SD = 1.05638). A statistically significant association was further noted between respondents' severity perception and COVID-19 vaccine uptake (χ^2 = 234.515, df = 3, P < 0.005). It can therefore be summed up that severity perception is a determinant of COVID-19 vaccine uptake. Similar discoveries were noted from a research done by Wong *et al*., (2021) which confirmed that Hong Kong residents sought COVID-19 vaccination services in the bid to counter severity that may come with the infection. In addition, a review by Wang and Liu (2022) further points out that several studies are in agreement with the discovery that a great percentage of individuals are likely to seek COVID-19 vaccination services owing to fear of infection following the threat appraisal posed by the disease. Therefore,

individuals with some pre-existing conditions such as chronic illnesses like diabetes, cancer, or even HIV/AIDS have a high likelihood of seeking the vaccination services against COVID-19 due to the fear of severity that may come with the disease if infected. The severity in these cases can be attributed to the impact of the chronic illnesses on the immune systems of the affected individuals.

Safety concerns were also noted with the respondents disagreeing to the statement that COVID-19 vaccine is safe and lacks major side effects (Mean = 2.9635, SD = 1.06142). This could be an indicator that the respondents were not well equipped with facts about the vaccine. A significant association was realized between COVID-19 vaccine safety perception and its uptake (χ^2 = 277.624, df = 3, P < 0.001). This therefore implies that safety concerns were among the determinants of COVID-19 vaccine uptake. A survey carried out by Orangi *et al*., (2021) published similar findings whereby higher odds of being hesitant towards acceptance of COVID-19 vaccination were noted among Kenyans who had concerns with the safety of the vaccine. Further, these findings align those from a study by Simkhada et al., (2022) which engaged citizens from Nepal residing in the UK and established that safety concerns about COVID-19 vaccines is a critical drawback to vaccine uptake. In summation, all this evidence points out to the negative impact of the safety issues revolving around the COVID-19 vaccines globally on acceptance of the vaccination services and ultimate global control of the pandemic.

The fact that COVID-19 vaccine benefits outdo the associated side effects was faced with a lot of disagreement (Mean = 2.9635, SD = 1.06142). Further cross-tabulations indicated a statistically significant association between the two variables (χ^2 = 277.624, df = 3, P < 0.001). Therefore, COVID-19 vaccine uptake can be said to depend on individual understanding of the associated benefits over side effects. Fear of side effects as an element likely to affect vaccine uptake was also found out in a related study by

(Saied *et al*., 2021) which engaged individuals taking medical courses in Egypt. In addition, a study carried out by Tsang, (2022) found out that residents of Hong Kong who were willing to take up COVID-19 vaccination services pointed out benefits associated with the vaccine as a key motivating factor to take it. This therefore implies that being better informed about the importance of COVID-19 vaccine in offering immunity against the disease and the few associated mild aftereffects, people would be more encouraged to embrace and acquire the services.

4.2.4 Administrative Factors:

Despite the low COVID-19 vaccine uptake, a greater proportion of the respondents (82.55%) had access to the vaccines in their nearby vaccination centers and hence not affected by vaccine stock-outs. No statistically significant relationship was noted between stock-outs of the COVID-19 vaccines in the accessible vaccination centres and individual vaccine uptake (OR = 0.86, 95% CI 0.82 – 0.90). This therefore confirms that vaccine acceptance was not pegged on respondents' accessibility and availability of the vaccines. These findings however indicate a slight disparity with those from a survey performed by Muchiri *et al*., (2022) to evaluate accessibility of the COVID-19 vaccination centres by Kenyans across the 47 counties in Kenya. They found out that some individuals residing in some counties still had difficulties in accessing the vaccination centres with more than 50% of the residents having to travel for not less than one hour to their nearest COVID-19 vaccination centres. This could however be due to marginalization of such counties as well as the sparse distribution of the residents within these counties. On the positive end, the authors found out that majority of the counties including Machakos had more than 90% of the population recording a travel duration of less than one hour to the vaccination centres.

Likewise, majority of the respondents (88.02%) were not affected by long queues in the vaccination centers. A binomial logistic regression model also noted that no statistically significant relationship existed between long queues in vaccination centers and COVID-19 vaccine uptake (OR = 0.87, CI 95% 0.83 – 0.90). These findings however differ with those published by Afrifa-Anane *et al*., (2022) which point out long queues and long waiting time in the COVID-19 vaccination centres in Ghana as key barriers to acquiring the vaccination services. This disparity in findings could be explained by difference in study locations since this study was carried out in Kenya which has different health systems, structures, and policies from Ghana. Therefore, long queues were not a barrier to individuals seeking the vaccination services. This could be due to equitable distribution of the vaccines across the vaccination centres within the county with the appropriate capacity to maintain the cold chain and keep the vaccines viable for use. Additionally, these findings could be due to the frequent COVID-19 vaccination campaigns organized by the Sub county health management team thus allowing more eligible individuals acquire the services without necessarily going to the healthcare facilities.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS:

5.0 Introduction:

This part encompasses summary of the key findings, conclusions, as well as the key recommendations.

5.1 Summary of the Research Findings:

The results indicate a notably low uptake of COVID-19 vaccine by the eligible inhabitants of Mwala Sub-county. Further, the study realized a great level of vaccine hesitancy among the respondents from the fact that some were still reluctant to seek the services despite the health education and awareness campaign efforts put in place by the healthcare workers. Additionally, high level of vaccine drop-out was also noted from the respondents who were already in the vaccination program.

The key results established that demographic factors of the respondents had a notable influence on their vaccine uptake. In this regard, the demographic elements entailed age, sex, education level, as well as marital status. In addition, social factors of social media misinformation, collective responsibility of getting vaccinated in the effort to protect others from COVID-19 infection as well as religious teachings were significantly associated with the respondents' vaccine uptake.

The study findings further realized a significant influence of respondents' individual factors on COVID-19 vaccine uptake. Among the individual determinants were vaccine's safety concerns and associated benefits over side effects. In this regard, those who perceived the vaccines as harmless as well as beneficial in offering immunity to counter COVID-19 embraced the vaccination services unlike those who held contrasting opinions. Additionally, perceived severity and susceptibility towards the disease also fell in this category whereby individuals who felt to be more susceptible or

the disease would be more severe on them if infected intended to seek or had already sought the vaccination services.

On the other hand, administrative factors did not determine COVID-19 vaccine uptake. The major reason for this was because vaccine stock-outs in the respondents' accessible healthcare facilities was not a problem anymore owing to constant supply of different types of vaccines. Additionally, increased community outreach vaccination programs made the vaccines more accessible and available to the respondents thus countering possibility of long queues in the vaccination centers. With the Sub county health management teams maintaining the COVID-19 vaccination campaigns within the market places, residential areas, churches and other social places, more Kenyans will have a closer access to the vaccination services and vaccine literacy hence improving their uptake of the services.

5.2 Conclusion:

This research study concludes that uptake of COVID-19 vaccine is low in Mwala Sub-county. Further, high vaccine fall-out rates have been noted. Following the poor vaccine uptake noted among the respondents, residents of Mwala Sub-county remain vulnerable to COVID-19 infections.

The study further associates demographic factors with COVID-19 vaccine uptake. Additionally, social factors like social media misinformation, religious teachings, and collective responsibility are key influencers of COVID-19 vaccine uptake.

This research study further sums up that individual variables of risk perception, safety issues, and the underlying vaccine benefits over harmful effects factor as determinants of uptake of COVID-19 vaccination services. To the contrary, administrative factors are

not influencers of the vaccine uptake following the government's interventions to make several doses available and accessible to the general population.

5.3 Recommendations:

5.3.1 Recommendations for the Kenyan Ministry of Health and Mwala Sub County Health Management Team:

To increase COVID-19 vaccine uptake nationally, the government should incorporate COVID-19 vaccination into the existing routine immunization schedule. This will increase coverage across the eligible population hence improving the vaccine uptake by different age groups. Additionally, this will boost vaccine uptake by people from all levels of education.

With the study findings indicating low COVID-19 vaccine uptake, Mwala Sub County health management team has a critical role which may reverse the trend. Firstly, it is important for the management to address COVID-19 conspiracy theories spread through social media platforms. This can be done during COVID-19 vaccination campaigns to equip the public with the right information regarding COVID-19 and its vaccine. Additionally, the concept of collective responsibility should be taught during these campaigns to encourage vaccine uptake in the bid to ensure that the public gains herd immunity against COVID-19. Further, the management can consider educating the public about the safety as well as the benefits of the vaccine since some respondents considered it unsafe and unhelpful to their immunity. This will be essential in addressing population's safety concerns and increasing their awareness on benefits of the vaccine. With the population getting more informed about the advantages allied to the COVID-19 vaccine, health literacy is likely to improve among Kenyans hence having them more encouraged to embrace the vaccination services.

5.3.2 Recommendations for Further Research in this Field of Study**:**

This research study has opened avenues for other research studies in the future. Firstly, upon implementation of the aforementioned recommendations, another research study can be conducted in the Sub County to describe the vaccine uptake and consequently the impact of the interventions. Additionally, a similar study can also be done in future to highlight the determinants of COVID-19 booster vaccine uptake.

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APPENDICES

Appendix I: Informed Consent Form

The key aim of this research entails identifying the determinants of COVID-19 vaccine uptake by adults in Mwala Sub-county. The information you give could be quite useful in designing interventions aimed at improving vaccine availability, accessibility, and uptake which is quite necessary in containing the COVID-19 pandemic. You are hereby invited in this study to give any information required in the questionnaire willingly without any harassment or coercion. This may take you up to 20 minutes. Though the questionnaire may contain some personal questions, the data you give out shall be kept confidential. The research will highly consider anonymity of your participation in this study. There will be no payments for the participation but the information acquired will be of great importance to the haste towards herd immunity against COVID-19. To confirm your voluntary participation in this study please sign in the provided space below.

Signature of the participant: _____

Date of interview: _____

Appendix II: Questionnaire

Consent Form:

The study's primary target is the identification of key factors likely to influence COVID-19 vaccine uptake amidst adults in Mwala Sub-county. The information you give could be quite useful in designing interventions aimed at improving vaccine availability, accessibility, and uptake which is quite necessary in containing the COVID-19 pandemic. You are hereby invited in this study to give any information required in the questionnaire willingly without any harassment or coercion. You can discontinue with the questionnaire at any point you may find necessary. This can take you up to 20 minutes. The research will highly consider anonymity of your participation in this study. There will be no payments for the participation but the information acquired will be of great importance to the haste towards herd immunity against COVID-19.

Do you confirm your voluntary participation in this study? Y☐ No☐

INDIVIDUAL, SOCIAL, AND ADMINISTRATIVE DETERMINANTS OF COVID-19 VACCINE UPTAKE AMONG ADULTS IN MWALA SUBCOUNTY, MACHAKOS COUNTY, KENYA

INSTRUCTIONS TO THE RESPONDENT: Please tick and clarify where appropriate.

SECTION A: SOCIODEMOGRAPHIC DATA

1. Gender Male ☐ Female ☐

2. Age in years 18 – 34 ☐

35 – 50 ☐

51 – 65 ☐

65+ ☐

3. Religion Christianity ☐

Muslim ☐

Hindu ☐

Other (specify) ☐

4. Level of education No school completed

Primary ☐

Secondary ☐

Tertiary ☐

5. Marital status Single ☐

Married ☐

Divorced ☐

Separated ☐

SECTION B: COVID-19 VACCINATION STATUS:

1. a) Have you been vaccinated against COVID-19? 1. Yes 2. No

b) If yes in (a) above, are you fully vaccinated? 1. Yes 2. No

2. If your answer in 1(a) above is 'no', are you intending to get the vaccine anytime soon?

1. Yes 2. No

3. a) If no in 1(b) above, are you intending to get fully vaccinated? 1. Yes 2. No

b) If no in 3(a) above, what is the reason behind your fall out of the vaccination program? ☐

Side effects of the first dose

The first dose was enough to offer immunity against COVID-19 ☐

Others ☐ (specify)……

SECTION C: INDIVIDUAL AND SOCIAL FACTORS ASSOCIATED WITH VACCINE UPTAKE:

1 a) How would you rate your susceptibility to COVID-19?

Highly susceptible ☐ Less susceptible ☐

b) If your answer in 1(a) above is less susceptible, why do you think so?

☐

Am not a healthcare worker

I don't attend public gatherings very often ☐

I adhere to all COVID-19 prevention guidelines ☐

Others (specify)……..

2. I have been/I plan to acquire COVID-19 vaccination services because if I fell ill the disease would be severe on me owing to pre-existing health conditions

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

3. The COVID-19 vaccine is safe and does not have major aftereffects

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

4. The benefits of the vaccine outdo the associated side effects

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

5. Taking the vaccine has helped/will help me protect my family and friends from possible infection

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

6. Which of the items listed below has been the main source of information pertaining COVID-19 and COVID-19 vaccine?

Mainstream broadcast (Television and radio) ☐

Mainstream print (Newspapers) ☐

Online media (verified websites) ☐

Social media (Facebook, Twitter etc) ☐

Other (specify) ☐

7. Does your religion support or is against COVID-19 vaccination?

Support ☐ Against ☐

SECTION D: ADMINISTRATIVE FACTORS ASSOCIATED WITH VACCINE UPTAKE:

1. Has vaccine stock-outs affected your search for the vaccination services in the health centres?

Yes ☐ No ☐

2. a) Have you encountered long queues in the vaccination centres?

Yes ☐ No ☐

b) If yes in (a) above, have the long queues barred you from getting vaccinated?

Yes ☐ No ☐

Appendix III: Key Informant Interview Guide:

Welcome and Introduction:

Hi, I am Kilonzo Kimolo, a Master of Public Health student in Mount Kenya University. I am presently performing a research to highlight the key determinants of COVID-19 vaccine uptake by adults in Mwala Sub-county and it is my pleasure to welcome you to this key informant interview on my study topic.

Informed Consent:

Your participation in this session is voluntary and you can drop out of the interview at any point you may deem necessary. Additionally, no individual benefits will be awarded for your participation. Your feedback will be recorded anonymously and the responses treated with utmost confidentiality.

Do you consent to participate? 1. Yes 2. No

Questions	**Summary of the responses**
What is your take on safety of the COVID-19 vaccine?	
What is your opinion on usefulness of the COVID-19 vaccine?	
How often does your facility experience COVID-19 vaccine stock-outs in your facility?	
Do you believe that the COVID-19 vaccines are sufficiently distributed in health facilities in Mwala Sub-county?	
Do you conduct health education within the area to heighten public awareness on the vaccine's necessity?	
Do you inform the public about availability of the COVID-19 vaccines in your facility after restocking them?	
What do you think are some of the drawbacks barring adults in this area from seeking COVID-19 vaccination services?	
Do you have COVID-19 vaccination targets in place and if so, what are some of the strategies in place to hit the set targets in time?	

Appendix IV: Mount Kenya University Introductory Letter:

Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MPH/2020/68053

2nd June, 2022

The Director, Research Coordination Division
National Commission for Science, Technology & Innovation
Utalii House, 8th & 9th Floor
P.O Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: KILONZO KIMOLO - REGISTRATION NUMBER, MPH/2020/68053

The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health** in the **Department of Epidemiology and Biostatistics** in the **School of Public Health.**

The title of his research is *"Assessment of Determinants of Covid - 19 Vaccine Uptake among Adults in Mwala SubCounty, Machakos County, Kenya."*

He has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for his research between **June and September, 2022.**

Any assistance accorded to him will be highly appreciated.

Thank you

Mount Kenya University
P. O. Box 342 - 01000, THIKA
Office of the Director
Graduate Studies

Dr. Samuel M. Kaleinga, Ph.D
Director, Graduate Studies
Enc.

Appendix V: Mount Kenya University Ethical Clearance Certificate:

Mount Kenya University

REF: **MKU/ERC/2147** Date: 01 April 2022

TO: **KILONZO KIMOLO**

REG: **MPH/2020/68053**

Dear Sir/Madam,

RE: ASSESSMENT OF DETERMINANTS OF COVID-19 VACCINE UPTAKE AMONG ADULTS IN MWALA SUBCOUNTY, MACHAKOS COUNTY, KENYA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1220.** The approval period is **01/04/2022 - 31/03/2023.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

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.

The Chairman
Mount Kenya University
Ethics Review Committee
P. O. Box 342 - 0100, Thika

Yours sincerely,

Dr. Peter G. Kirira
Chairman, Mount Kenya University IERC

Appendix VI: NACOSTI Research License:

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **433846**

Date of Issue: **22/June/2022**

RESEARCH LICENSE

This is to Certify that Mr.. Kilonzo Kimolo of Mount Kenya University, has been licensed to conduct research in Machakos on the topic: ASSESSMENT OF DETERMINANTS OF COVID-19 VACCINE UPTAKE AMONG ADULTS IN MWALA SUBCOUNTY, MACHAKOS COUNTY, KENYA for the period ending : 22/June/2023.

License No: **NACOSTI/P/22/18170**

433846

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

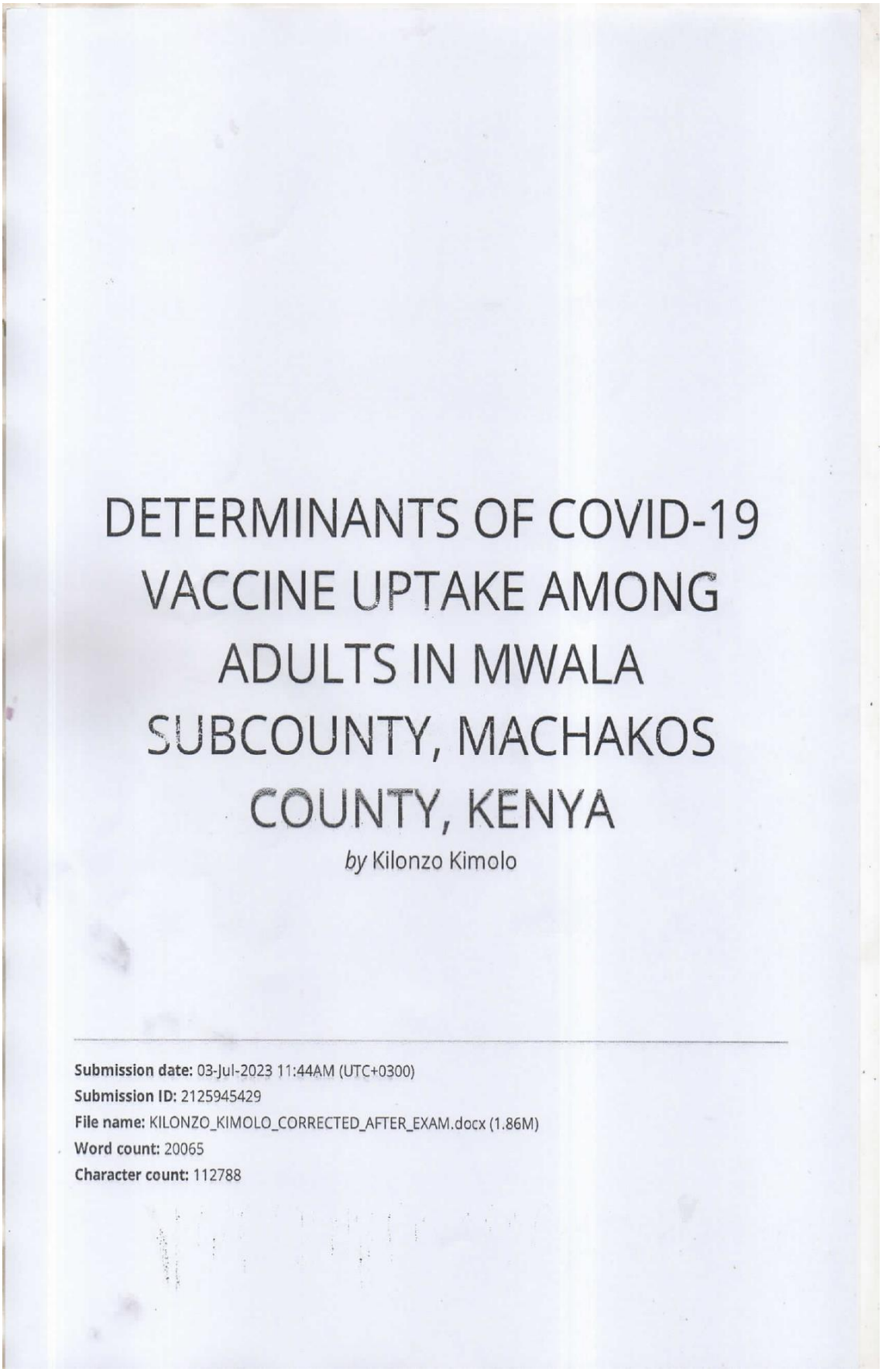
Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix VII: Map of Mwala Sub-county

Source: Mutua, J. K., Kanui, T. I., & Orenge, C. O. (2017).

Appendix VIII: Similarity Index



DETERMINANTS OF COVID-19 VACCINE UPTAKE AMONG ADULTS IN MWALA SUBCOUNTY, MACHAKOS COUNTY, KENYA

by Kilonzo Kimolo

Submission date: 03-Jul-2023 11:44AM (UTC+0300)
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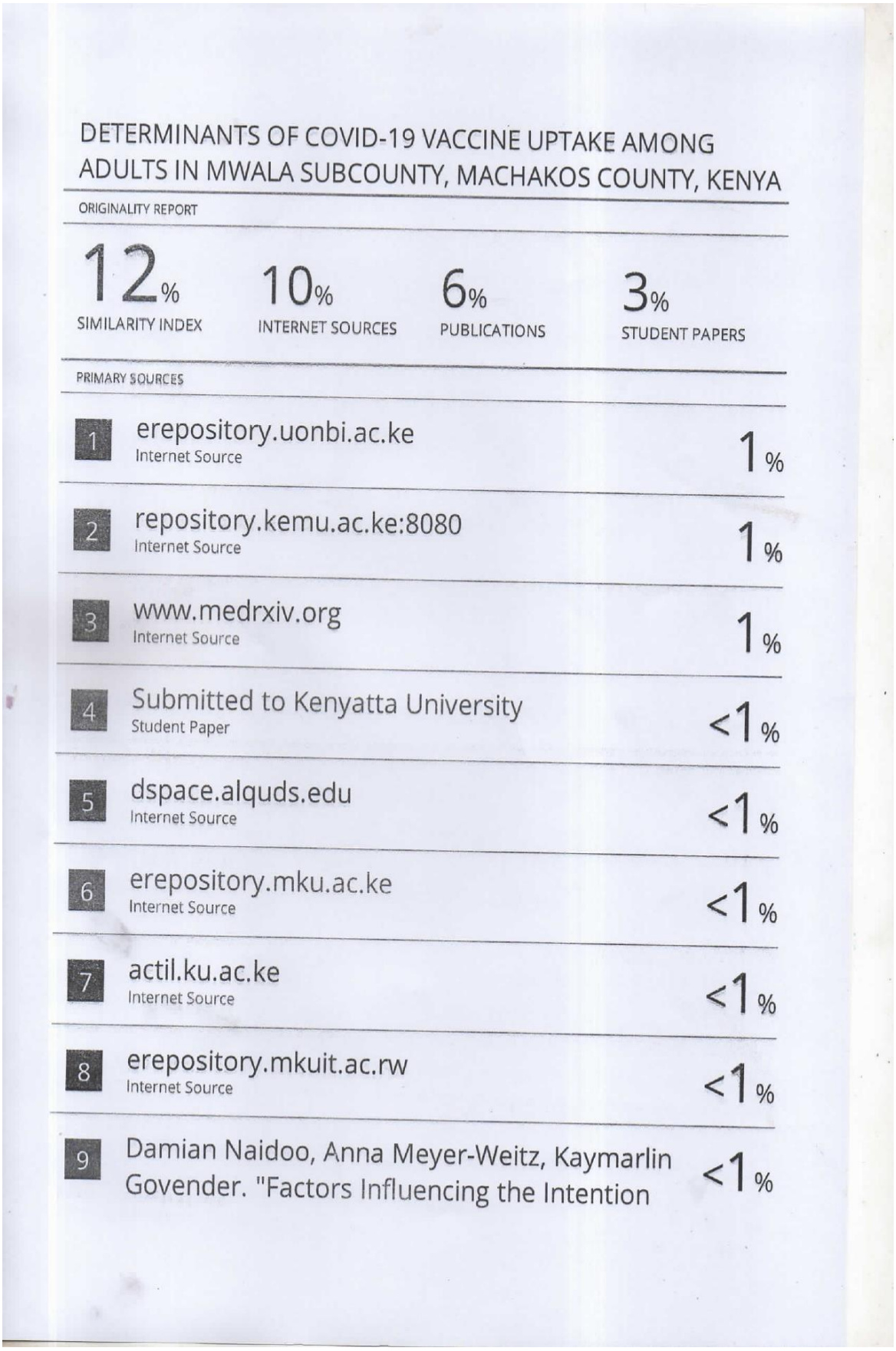

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