FACTORS ASSOCIATED WITH COVID-19 VACCINE HESITANCY AMONG STUDENTS AT THE UNIVERSITY OF NAMIBIA, MAIN CAMPUS, KHOMAS REGION

A RESEARCH PROPOSAL/ A MINI THESIS/THESIS/DISSERTATION SUBMITTED IN PARTIAL FULFILMENT/FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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ABSTRACT

The emergence of the COVID-19 pandemic heightened global health concerns, leading governments to engage in research endeavours focused on forecasting, mitigating, and managing the disease. Despite the recognized efficacy of vaccination in controlling the spread and severity of COVID-19, vaccine hesitancy poses a significant challenge, particularly in low to middle-income countries like Namibia.This study aimed to investigate the factors associated with COVID-19 vaccination and vaccine hesitancy among students at the University of Namibia's main campus in the Khomas Region, Namibia.Employed a quantitative cross-sectional analytical approach, data was collected from 331 students using a self-administered questionnaire. The participants, selected through stratified random sampling, represented four faculties at the University of Namibia's main campus. Informed consent was obtained, and SPSS version 27 facilitated data analysis through univariate, bivariate, and multivariate techniques.The study revealed a low vaccination rate (24.2%) and high hesitancy (48%) among students, with females exhibiting more hesitancy than males. Factors such as gender, faculty of study, safety and side effect concerns, lack of trust in vaccine development and healthcare providers, political influences, information from friends, and attitude were significantly associated with vaccine hesitancy ($p<0.05$).This study contributes to existing knowledge by highlighting a low vaccination rate and high hesitancy among university students. While various factors showed associations with vaccine hesitancy, concerns about safety (OR=3.278: CI;1.403-7.659), concerns about side effects (OR=7.374: CI;3.709-14.658) and other concerns (OR=19.188: CI;2.057-178.992) emerged as predictors of vaccine hesitancy. Recommendations include targeted educational campaigns within faculties, policy incentives for vaccination, fostering peer-led discussions, and ongoing research collaboration. Implementation of these measures aims to address vaccine hesitancy among University of Namibia students, promoting a safer campus environment and contributing to broader public health efforts.

Key words: Hesitancy, COVID-19, Students, Vaccine, Namibia, Windhoek

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LIST OF ABBREVIATIONS

AEFI	Adverse Events Following Immunization
COVID-19	Coronavirus disease of 2019
DNA	Deoxyribonucleic acid
DTP	Diphtheria, Tetanus, And Pertussis
EPI	Expanded Program on Immunization
FDA	Food and Drug Administration
HEIs	Higher Education Institutions
HIV	Acquired Immunodeficiency Syndrome
HOD	Head of Department
MMR	Measles, Mumps and Rubella
mRNA	messenger Ribonucleic Acid
PCV	Pneumococcal Conjugate
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2

SONPH-DEC	School of Nursing and Public Health Decentralized Research Ethics Committee
SPSS	Statistical Package for Social Science
UNAM	University of Namibia
USA	United States of America
WHO	World Health Organization

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DECLARATION

I, Justine Heita, hereby declare that “Factors associated with COVID-19 vaccine hesitancy among students at the university of Namibia, main campus, Khomas region” is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any institution. No part of this thesis/dissertation may be reproduced, stored in any retrieval system, or transmitted in any form, or by means (e.g. electronic, mechanical, photocopying, recording or otherwise) without the prior permission of the author or The University of Namibia on that behalf.

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CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The chapter introduces the study by providing the background information of what prompted the study, the problem statement, the research questions of the study, the significance of the study, the limitations or the scope of the study, as well as the outline of the thesis.

The global health crisis caused by COVID-19 prompted governments worldwide to collaborate on research initiatives focused on predicting, mitigating, and addressing the disease. The effectiveness of COVID-19 vaccines is dependent on their acceptance rates. Vaccine hesitancy has been identified by the World Health Organization (WHO) as a major challenge to global vaccination efforts [1]. Despite the widespread implementation of vaccination programs, outcomes varied significantly across nations, with diverse responses observed in different countries [2]–[5].

SARS-CoV-2, the virus responsible for COVID-19, is categorized as the seventh identified coronavirus that affects humans. It belongs to the family of severe acute respiratory syndrome viruses. In March 2020, WHO officially declared the COVID-19 outbreak a global pandemic [6]. Simultaneously, numerous scientists and experts globally anticipated that low and middle-income nations would be the most impacted from this global health crisis. Africa, a continent that is one of the least

developed regions and has limited resources for public health response, has garnered significant attention and prompted significant concerns. Considering the global pandemic, numerous nations-initiated research endeavors explored methods for the prediction, mitigation, and treatment of the disease [7]. Scientists sought insights not only into pharmaceutical treatments but also into the behavioural patterns of community members affected by COVID-19-related concerns. Presently, it appears that the African continent exhibits a relatively limited quantity of studies related to the topic of COVID-19.

Numerous scholars assert that the efficacy of COVID-19 vaccinations is contingent exclusively upon their rate of adoption [6],[8]. Although the WHO has recognized vaccination as a key strategy for mitigating the global impact of the pandemic, it is evident that the vaccination program has elicited diverse and perplexing reactions on a global scale. According to WHO, as of June 15, 2022, just 23.8% of Namibians, out of an initial target population of 1,779,271, have been fully vaccinated [9]. According to DeLong et al. [10], there is a significant disparity in the vaccination rates between certain African countries, where the percentage of vaccinated individuals is below 10%, and industrialized economies, where the percentage of vaccinated individuals exceeds 60%. This observation suggests that the Africa has a relatively low rate of response to COVID-19 immunization efforts. The researcher aims to clarify the underlying factors contributing to the significant levels of vaccine hesitancy seen concerning COVID-19.

1.2 BACKGROUND OF THE STUDY

In January 2020, the COVID-19 virus was initially detected in Wuhan, China. Subsequently, immunization has proven to be a highly cost-effective and influential public health strategy for controlling the transmission of contagious diseases [11]. Currently, various vaccine types are available, including inactivated vaccines, attenuated influenza virus vector vaccines, recombinant protein vaccines, adenovirus vector vaccines, and nucleic acid (mRNA and DNA) vaccines [12]. However, researchers contend that vaccine hesitancy poses a substantial obstacle to the ongoing global immunization efforts [4],[13].

The University of Namibia (UNAM) has experienced a notable impact on its personnel and amongst its students as a result of the COVID-19 pandemic. As of March 2023, the UNAM's Occupational Health Department has documented a total of 13 fatalities attributed to the pandemic. Furthermore, their records about COVID-19 cases from September 2020 to July 2021 reveal an approximate count of 654 individuals who tested positive for the virus. This circumstance renders the University particularly well-suited for the present study. According to the findings of the occupational health and safety department, it is suggested that not all individuals who succumbed to COVID-19 may have had complete vaccination. Unfortunately, there is a lack of relevant data regarding the vaccination status of students.

The exposure of the first two cases, which involved a Romanian couple, similarly affected UNAM which had to cancel face-to-face classes in favor of online classes. After the university had earlier confirmed that it will resume its face-to-face examinations with the upcoming June/July 2021 exams, it later announced students would not sit for their first-semester exams due to the COVID-19 pandemic [14]. Organizations were required to shut down operations immediately in the same month that the first two COVID-19 occurrences were disclosed [15].

Despite the Namibian government's substantial efforts to promote workforce retention during the pandemic, a significant proportion of people reported job losses in companies that remained operational. Specifically, 18.4% of individuals in urban areas and 11.9% in rural regions experienced layoffs from these functioning businesses [16]. According to WHO, by 2022, the world has documented more than 470 million cases and 6 million deaths. There were 157,545 confirmed cases of COVID-19 in Namibia, and 4,016 people died. [1].

Vaccination is a very efficacious, secure, and straightforward method of safeguarding persons from perilous diseases. It operates by harnessing the body's innate mechanisms of protection against infections, thereby bolstering the immune system [1]. According to the WHO [1], vaccines consist of attenuated or inactivated pathogens, and they do not pose a danger of problems or disease acquisition for persons. Nevertheless, these interventions facilitate the development of antibodies within the body's immune system [1]. The overall health and well-being of the entire population are significantly impacted by vaccines, as seen by the successful

worldwide immunization campaigns that have led to the elimination of diseases such as measles, polio, rubella, and the complete eradication of smallpox [17]. Vaccinations are administered regularly throughout one's life due to their beneficial effects. An example of such a program is the expanded program on immunisation, which encompasses various vaccines such as DTP, Hib, MMR, hepatitis B, polio, and varicella [18]. This extensive program has effectively stopped around 14 million new infections, prevented 33,000 early deaths, and generated substantial savings in healthcare costs. Moreover, the overall impact of vaccines has resulted in increased life expectancy, the eradication of disruptive epidemics within communities, and safeguarding against a wide range of acute infectious diseases and their associated long-term complications [18]. In addition, the implementation of new vaccines such as pneumococcal conjugate (PCV), hepatitis A, and rotavirus has demonstrated a substantial decrease in infections and hospitalizations within specific populations. Furthermore, these advantages have been accompanied by a reduction in the transmission of infection from individuals who have been immunized to other groups [18].

Historical records indicate that, before the development of vaccines, a limited number of individuals managed to reach adulthood without experiencing the adverse effects of several diseases such as mumps, rubella, measles, chickenpox, whooping cough, and rotavirus diarrhoea [19],[20]. The crucial importance of vaccinations in preserving human lives is widely acknowledged. Nevertheless, there exist numerous problems that currently pose a danger to the gains accomplished in immunization efforts [21]. The obstacles encompass issues about the safety of vaccines and vaccine hesitancy, characterized as the deliberate delay or refusal of vaccination despite the

presence of vaccination services [17],[21],[22]. Moreover, recent epidemics, such as measles, have been linked to public complacency regarding the efficacy of vaccines, which may have been averted with their utilization [23].

The persistence of these issues is unfortunate, given the increasing body of research about vaccine hesitancy in the context of the ongoing COVID-19 pandemic [24]–[26]. Vaccine hesitancy refers to the reluctance of individuals to receive vaccination despite the accessibility and availability of vaccines throughout the population [22]. The phenomenon is intricate and encompasses a diverse array of interconnected influences [27],[28]. Furthermore, it has been suggested that vaccination hesitancy is commonly characterized by a lack of accurate information, widespread prevalence, and the ability to spread among individuals [29].

The occurrence of vaccine hesitancy presents a major obstacle to the current initiatives intended to reduce the transmission of the COVID-19 virus. Previous research has identified several factors that are linked to the phenomenon, including but not limited to: younger age, female gender, lower income and educational attainment, diminished trust in medical institutions, belonging to minority ethnic groups, perceiving a lower risk of contracting COVID-19, engaging with specific social media platforms, and endorsing conspiracy theories [28],[30],[31]. Nevertheless, there remains a lack of clarity regarding the specific predictors that may account for the variation observed concerning one another [32]. Hence, the objective of this research is to identify the underlying causes that contribute to vaccine reluctance among young individuals, with a specific focus on university students.

The Republic of Namibia has a suboptimal immunization rate, (38.2 %) and a comprehensive investigation into the underlying factors contributing to this phenomenon remains incomplete. The WHO has recognized vaccination as a viable approach to mitigating the global impact of the pandemic [27]. The WHO has set a target of achieving complete vaccination coverage for 70% of the population in every country by the conclusion of June 2022. At present, it is seen that solely three nations within the African continent, namely Liberia (78.9%), Mauritius (86.0%), and Seychelles (76.7%), have achieved the milestone of fully vaccinating more than 70% of their entire population [33]. Conversely, a noteworthy proportion of African countries, including a quarter of the total, continue to exhibit a vaccination rate below 10% [33].

1.3. PROBLEM STATEMENT

Vaccine hesitancy is widely recognized as a significant obstacle in the ongoing battle against the COVID-19 pandemic [34]. By the end of March 2023, Namibia had recorded 4,020 fatalities due to COVID-19 [35]. The issue of vaccination hesitancy is a significant concern for global health, particularly considering the COVID-19 pandemic 2020 - 2021. WHO [1] has previously noted that, the global death toll from COVID-19 stands at 4,627,540, with 84,877 deaths reported in South Africa in 2020. Furthermore, the phenomenon of vaccine hesitancy poses a significant challenge to the efficacy of vaccination campaigns and has the potential to impede communities from achieving the essential level of immunization needed to establish herd immunity against the COVID-19 virus [36].

In contrast South Africa, as a neighbouring country to Namibia, through the Department of Health aimed to achieve a 70% vaccination rate among its population by the close of December 2021. As of August 2021, more than 20.93% of people had been inoculated with either the Johnson and Johnson or Pfizer vaccines. However, a considerable segment of the population remains hesitant to get vaccinated, potentially hindering the Department of Health's vaccination efforts [32].

Namibia has undergone a process of recuperation from the profound repercussions of the COVID-19 pandemic. As of March 2023, the UNAM's Occupational Health Department has documented a total of 13 fatalities attributed to the pandemic. Furthermore, their records about COVID-19 cases from September 2020 to July 2021 reveal an approximate count of 654 individuals who tested positive for the virus. Among the population, there were a total of 350 confirmed positive cases among students, with one fatality attributed to COVID-19. Vaccination has been widely acknowledged to enhance health outcomes. However, the acceptance and adoption of vaccines can be influenced by individual views, leading to varying rates of vaccine hesitancy across different countries [37].

Based on the most recent report from the WHO, the proportion of individuals who had received vaccinations in the Khomas region amounted to merely 28% of the intended target population, which stood at 362,620 and has since increased to 494 605 according to the Namibia Statistics Agency. Although there is a scarcity of research on vaccine hesitancy in Namibia, a previous study revealed that 58.6% of students expressed unwillingness to receive vaccinations [38]. Despite continued efforts to increase uptake of vaccination, it is important to note that the factors

related to vaccination uptake and hesitancy among the mentioned study group remain unknown.

1.4. RESEARCH AIM AND OBJECTIVES

The study aimed to investigate the factors associated with Covid19 vaccinations and vaccine hesistancy amongs students at he UNAM's main campus in the Khomas region, Namibia

The objectives of this study were to:

- Determine prevalence of vaccination and associated factors among students at the University of Namibia.
- Determine the factors associated with Covid-19 vaccine hesitancy among students at the University of Namibia.
- Analyse predictors of Covid-19 vaccination and vaccine hesitancy among students at the University of Namibia.

1.5. SIGNIFICANCE OF THE STUDY

This work represented a pioneering effort conducted at the University of Namibia. The findings of this study offered the potential to inform the establishment of immunization programs in subsequent periods. The results obtained from this study may offer valuable insights for the training institution, the Ministry of Health and Social Service, and public health responses. Subsequent researchers could identify gaps within the present study's findings and subsequently undertake further research endeavours to address these gaps. The research held significance due to its examination of a prevalent health and societal concern. The results of this study

contributed to the knowledge base of scientists, health practitioners, and community leaders, enhancing their understanding of social behaviours and facilitating informed decision-making in the realm of motivating and supporting vaccination uptake in the future.

1.6 DELIMITATIONS OF THE STUDY

This study was limited to full-time students no age limit at the University of Namibia's main campus in Windhoek, Khomas region during the UNAM calendar year of 2023. Students studying at other campuses were excluded from the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

WHO declared the COVID-19 a public health emergency on January 30, 2020 [1]. Namibia reported its first two COVID-19 cases on March 13, involving two Romanian tourists [39]. The Namibian President proclaimed a state of emergency on March 17, 2020 [39]. The escalating number of infections has led to various intricate issues, such as financial difficulties, untimely deaths, and challenges in fulfilling work and educational responsibilities [40]. These concerns are intertwined with challenges related to the fair and equitable availability of healthcare services, alongside the prevailing skepticism surrounding COVID-19 vaccination [41]. Furthermore, the increase in COVID-19 infections has necessitated the implementation of compulsory vaccination policies in various settings, such as workplaces and educational institutions.

2.2 EFFECT OF COVID-19 ON HIGHER EDUCATION STUDENTS

Higher education students have been significantly impacted by the ongoing pandemic, with approximately 220 million students engaged in higher education globally experiencing a total disruption in their regular study regimen [32]. In various global regions, higher education institutions (HEIs) were required to put in place preventive measures. These measures included the suspension of in-person instruction, the closure of on-campus facilities, and the transition of workers and the

students to remote work and learning [7]. The implementation of state regulations necessitated an abrupt transition from traditional classroom instruction to online teaching for pupils. The necessary measures implemented to prevent infections caused by SARS-CoV-2 and establish a secure working environment and also a learning environment necessitated certain adjustments on the part of higher education students. Furthermore, this phenomenon also exerted an impact on both the physical and mental well-being of individuals. The COVID-19 pandemic has had a disproportionately adverse impact on higher education students compared to the broader population [42].

Higher education students have reported a decline in subjective wellbeing and an increase in unpleasant emotional symptoms during the COVID-19 pandemic [43]. The presence of ambiguity regarding the organization of courses and examinations has resulted in heightened levels of stress among students, exacerbating negative emotional symptoms and fostering concern about their future careers [44]. Higher education students in the COVID-19 pandemic may encounter a range of significant challenges, such as feelings of isolation, financial constraints, a decline in health-related behaviours, a rise in mental health concerns and the need to adapt to changing study conditions, online instruction. The skills and access to the technology needed was also a barrier with the need to own or have steady access to a computer or online device necessary to participate in online learning. Additionally, there was a steep learning curve, system requirements, and managing glitches with online-only instruction which created a higher barrier to learning than before. The COVID-19 epidemic has presented significant challenges in the realm of education,

particularly in the training of a substantial portion of the prospective labour force. In order to mitigate the adverse consequences, it has been imperative to adhere to protective and hygienic protocols, enabling the continuation of in-person classes during the ongoing pandemic [44].

The distribution of face-to-face instruction has varied among Higher Education Institutions (HEIs) throughout the COVID-19 epidemic, influenced by both teaching approaches and the physical capacity of the HEIs [44]. On April 1, 2020, the physical campuses of various higher education institutions (HEIs) underwent a complete closure, resulting in the exclusive provision of online teaching. Namibia UNAM was no exception and leaned towards less of physical classes to online version throughout the COVID period [45]. The regulation indicated that students could participate in indoor classes only if they provided proof of vaccination, proof of recovery from a COVID-19 infection, or a recent negative rapid antigen test result. Nevertheless, the regulation no longer included targeted protective measures for those at increased risk of severe COVID-19 symptoms. In the summer of 2021, individuals in Germany had the option to receive a COVID-19 vaccine if they wished to take advantage of the opportunity [46]. The willingness of students in HEIs to embrace vaccination and other preventive measures has significant implications for future teaching strategies and the adaptation of protective and health protocols within higher education institutions.

2.3 MANDATORY VACINATION POLICY

On December 9, 2021, the Austrian Government presented a bill to the parliament, advocating for the enforcement of a mandatory COVID-19 vaccine mandate for all Austrian citizens [47]. Following this development, the Prime Minister of Greece declared the intention to impose penalties on persons who are aged 60 years and above living in the country if they do not undergo COVID-19 immunization [48]. Likewise, several other countries, including Brazil, France, Australia, Canada, Italy, Indonesia, and the United Kingdom, had either started considering comparable directives or had already enacted COVID-19 regulations within specific occupational settings [49]

For the period of the pandemic,the French authorities in France instituted the implementation of a health pass, mandating individuals aged 12 years and older to present either a negative SARS-CoV-2 test result or proof of vaccination for entry into various public venues, including restaurants and libraries [50]. The implementation of the health pass had a major impact on the vaccination rates for COVID-19, leading to a substantial increase in the proportion of eligible individuals who received the vaccine. The percentage of the vaccinated population in France surged from 49% to 89% [50]. In 2021, several nations, including Germany, Chile, Israel, Norway, Mexico, Spain, and Serbia, successfully put in place rules that existed before the pandemic that gave the government the power to make sure people got their COVID-19 vaccines [51].

Subsequently, a significant number of colleges and universities in the United States of America (USA) declared their intentions to implement mandatory vaccination policies for students. These regulations also extend to include staff and faculty members [52]. Notably, the imposition of vaccine mandates by higher education institutions did not encounter significant legal opposition during perioed of the pandemic, and there was a possibility that the courts would support the compulsory administration of SARS-CoV-2 vaccines [53].

According to Gostin et al., [54], it is vital to consider that countries outside of the United States of America may face challenges in accessing vaccines that have been authorized by the Food and Drug Administration (FDA). This was mainly due to the fact that the USA had more resources for vaccine development in contrast to a small country like Namibia that did not have access to the amount of resources of the Uinted States of America. Therefore, careful consideration should be given to determining which specific vaccine items should be included in the mandate in Namibia. In addition, the WHO has provided a comprehensive list of vaccinations that have been approved for emergency use [55]. This list encompasses vaccines such as Sinopharm, Sinovac, and Oxford University/AstraZeneca, all of which have received authorization from the FDA. Hence, it is plausible for educational institutions in the United States to consider the acceptance of all vaccines identified as emergencies by the WHO[54]. Nevertheless, institutions will need to establish safety standards to accommodate individuals with religious and medical exemptions. These protocols may involve measures such as remote learning, symptom testing, and the usage of masks [56].

Limited research has been conducted in Africa regarding the implementation of compulsory COVID-19 vaccination due to the region's prevailing difficulties in ensuring adequate vaccine supply, equitable access, and efficient distribution [57]. Nevertheless, several sectors and organizations in Namibia previously enforced compulsory vaccination policies [58]. Furthermore, the Ministry of Higher Education in Namibia has mandated institutions of higher training to put in place COVID-19 safety measures, including vaccination. The enforcement of this policy requires all individuals, encompassing both students and staff members, to comply with COVID-19 safety measures, with vaccination being strongly encouraged, although it remains voluntary [59].

Despite facing criticism, a group of individuals contends that mandatory vaccination is not solely a reactive measure to address the COVID-19 pandemic. This perspective is substantiated by the existing practice of over 100 countries that have already instituted mandatory vaccination policies for school children, targeting a range of diseases including mumps, measles, polio, rubella, and tetanus [60]. Scholarly consensus suggests a fundamental compatibility between obligatory vaccination and human rights law. Moreover, a robust argument, rooted in rights, supports governments seriously considering the adoption of mandatory vaccination policies [61].

2.4 THE FACTORS RELATED WITH COVID-19 VACCINE HESITANCY AND THEIR IMPACT.

According to scholarly sources, the reluctance towards COVID-19 vaccinations, attributed to the lack of confidence, has had a major impact on global immunization efforts [5]. Vaccine hesitancy has been identified as a substantial factor in the global context, leading to a decline in vaccination rates and ultimately resulting in an increase in preventable diseases such as measles [62]. In contrast, a comprehensive analysis of worldwide surveys conducted in 149 countries from 2015 to 2019 indicates a growing body of evidence suggesting vaccine reluctance resulting from concerns over safety and doubts regarding the efficacy and significance of vaccines [62]. The consequences of these findings pose a notable threat to global public health. In light of the ongoing COVID-19 pandemic, it is anticipated that the effects of vaccine hesitancy will be more significant in this situation than in earlier pandemics [5].

Elements linked to hesitancy towards the COVID-19 vaccine include a range of demographic, socioeconomic, and psychological factors. Research has pointed out that political affiliation, median household income, the proportion of Black residents, and the average number of vehicles per household played a role in influencing vaccine hesitancy especially in the United States of America [6]. Conversely, a higher infection rate of COVID-19, a greater percentage of Hispanic individuals, an increased median age, a higher rate of educational attainment, and prior vaccination coverage for non-COVID-19 childhood diseases are all linked to lower levels of vaccine hesitancy in some part of the USA[6].

Futher in the USA, among adolescents, specific factors linked to vaccine hesitancy include being female, having primary education, sourcing information from social media, possessing poor knowledge about COVID-19 disease and the vaccine, and holding an unfavourable attitude [63]. Psychological factors such as illness attitude, high generalized anxiety, low collective responsibility, low confidence, and low reward dependence have also been identified as risk factors for vaccine hesitancy [63]. Moreover, college students aged 18-22 years in the USA, undergraduates, and those identifying as Black or Middle Eastern were found to be more likely to exhibit vaccine hesitancy or resistance [4]. Understanding these diverse factors is crucial for designing targeted interventions aimed at reducing vaccine hesitancy and increasing vaccination rates.

2.5 THE ROLE OF SOCIAL MEDIA IN VACCINE HESITANCY

Various factors contribute to the dissemination of vaccine hesitancy, with internet forums, especially social media, playing a prominent role in shaping individuals' perspectives [8]. Research has documented that individuals using social media and the internet are subject to direct influence stemming from an algorithmically curated web experience aiming to cater to their interests and exploit their psychological vulnerabilities [3]. It is essential to note that both online influencers and reliable offline sources continue to have a significant impact on shaping users' perceptions.

Vaccine hesitancy, especially concerning the COVID-19 vaccine rollout, persists in the online domain. Studies have examined the impact of anti-vaccine content on user engagement, revealing a higher prevalence of retweeting low-quality sources of misinformation regarding COVID-19 compared to high-quality information [8],[64]. Even minimal exposure to online platforms promoting anti-vaccine sentiments has been shown to lead individuals to develop heightened views of the hazards associated with vaccines [64]. This observation underscores the significant role of social media as a primary medium for the dissemination of misinformation and disinformation related to the COVID-19 pandemic, contributing to its rapid proliferation. Despite efforts by social media platforms, the dissemination of inaccurate information about the pandemic remains prevalent online. There are reports suggesting that frequent exposure to memes shared on social media platforms can potentially disseminate misleading information, often with the intention of humorously reinforcing such misinformation [8].

Emerging research from Europe and the USA indicated that individuals aged 18 to 29 generally exhibited a favourable disposition towards the COVID-19 vaccine compared to their older counterparts. However, young adults are susceptible to the dissemination of inaccurate information through social media due to their reliance on it as a source of health-related information and their limited proficiency in health literacy [64]. This constraint hinders critical analysis of social media information, making the youth susceptible to conspiracy theories regarding COVID-19 disseminated through online platforms.

This issue is compounded by the substantial quantity of TikTok posts containing discouraging content about the COVID-19 vaccine, depicting adverse events that occurred before vaccines were made available to the general population [65]. This intentional expression of anti-vaccination viewpoints is further exacerbated by the adverse effects of proactive actions, hindering the dissemination of current scientific information to vaccine-reluctant communities and the youth [8].

2.6 COVID-19 MISINFORMATION AND DISINFORMATION

The deliberate dissemination of false information is recognized as disinformation, whereas misinformation refers to inaccurate information that is not intentionally misleading [29]. Disinformation and misinformation are multifaceted phenomena characterized by diverse underlying causal elements and the public health response to COVID-19 must include a comprehensive examination of the sources and causes of disinformation, medical mistrust, and misinformation [29],[66].

There has been a notable prevalence of misinformation on COVID-19 within Black communities, characterized by the belief that the COVID-19 vaccine has been intentionally withheld and that the genesis of SARS-CoV-2 is of human creation [66]. These false beliefs can be attributed to misinformation and mistrust arising from inequality. It is crucial to comprehend the various origins of these beliefs to effectively communicate public health messages [29]. The presence of inequality contributes to a sense of mistrust and the dissemination of disinformation related to COVID-19, which may deter individuals from seeking medical care for COVID-19 or adhering to evidence-based preventive measures, which include wearing masks

and practising physical distancing [66]. The differences in COVID-19 infection, death, and illness rates between Black, Native American, and Latino groups need to be carefully looked at. Physical distance rules not being followed and a lower chance of agreeing to COVID-19 testing have been blamed for these differences [66]. Consequently, implementing efficient public health communication strategies is imperative to address these inequalities.

2.7 COVID-19 AND CONSPIRACY THEORIES

Conspiracy theories can be conceptualised as explanations of the secret cause of an event in that the occurrence is attributed to a secret cooperation among influential persons or groups rather than as an open action or as a course of natural events [67]. Multiple studies have provided data indicating that the propagation of conspiracy theories frequently results in the erosion of trust, dissemination of misinformation, and spread of disinformation [67]. Notably, this phenomenon is exacerbated by the involvement of health experts in these conspiratorial narratives, hence impeding their ability to effectively deliver credible evidence that challenges such beliefs [67].

A research that was conducted in March 2020 found that a notable percentage of the American population, specifically 29%, held the belief that COVID-19 was deliberately created in a laboratory [68],[69]. According to a previous survey, it was shown that nearly 71% of the American population demonstrated awareness of conspiracy theories associated with Covid-19 [70]. Furthermore, a quarter of the respondents expressed belief in the partial validity of these beliefs.

Moreover, there is an ongoing emergence of medical mistrust within black communities, similar to what was observed throughout the HIV pandemic [68]. Medical mistrust became extensively reported throughout the members of the black community and other areas that were disproportionately affected by the human immunodeficiency virus (HIV) pandemic [68]. For example, the African-American community had significant negative consequences associated with HIV due to their acceptance of HIV-related conspiracy theories. The expression of distrust concerning HIV is associated with the perception that the United States federal government played a role in both the development and dissemination of HIV as a means of perpetrating genocide against the members of the black community [71]. At the same time, some people believe that antiretroviral therapy is harmful and that the government and drug companies are keeping a cure hidden [68],[71]. Until now, there have been no significant alterations in the prevailing beliefs surrounding the HIV pandemic. The COVID-19 pandemic, however, exhibits comparable notions, such as the notion that COVID-19 is of human origin, pharmaceutical companies intentionally withhold the cure, COVID-19 is being used as a means of committing genocide against black individuals, and the COVID-19 vaccines poses potential harm [68].

During President Thabo Mbeki's term in South Africa, there was a notable instance of pandemic denialism, specifically in relation to acquired immunodeficiency syndrome (AIDS). This denialism was deeply ingrained among the top echelons of the government [72]. South Africa experienced a significant loss of life that could have been avoided. However, this loss occurred because of the government's

dissemination of false information, delayed recognition of HIV as a cause of AIDS, and the implementation of antiretroviral medication, which could have saved lives [73]. It is noteworthy to mention that the COVID-19 pandemic elicited a swift reaction, prompting Cyril Ramaphosa the President of South Africa to proclaim a state of disaster[74]. The implementation of a risk-adjusted level plan was accompanied by the imposition of a nationwide lockdown to mitigate the transmission of COVID-19. Irrespective of South Africa's first reaction, the proliferation of rumours and baseless conjectures persists as a catalyst for vaccine reluctance [2]. The dissemination of misinformation has resulted in individuals opting out of immunization, primarily driven by unfounded assertions that vaccines might cause infertility and contain infectious agents capable of transmitting HIV [75].

Throughout history, the acceptance and adoption of vaccines have been significantly influenced by the proliferation of negative assertions made regarding their efficacy and safety. For example, there was a prevailing belief that the administration of the polio vaccination was associated with infertility, resulting in a significant increase in the incidence of polio cases in Nigeria, Afghanistan, and Pakistan [17],[21]. Unsubstantiated hypotheses are a significant obstacle to the implementation of health policies and interventions by both governmental and non-governmental entities. Furthermore, it is unfortunate that the acceptance of disinformation regarding vaccinations is contingent upon an individual's health literacy and risk perception [29]. On the other hand, the continuous access to social media and the presence of online anti-vaccine posts contribute to the amplification of the

dissemination and the inclination to convey conspiracy theories and misinformation [8],[64].

2.8 COVID-19 VACCINES AND ADVERSE REACTIONS

The virus that causes Covid-19 exhibits genomic instability, leading to frequent and rapid changes. Consequently, there is a possibility that the reported efficacy of currently employed Covid-19 vaccinations may vary across different countries worldwide [76]. The variation in the efficacy of the Covid-19 vaccines can be attributed to the country of manufacturing and the strain involved. It is conceivable that an annual vaccination may be required to enhance protection against the virus [76].

Similarly, several Covid-19 vaccine candidates have demonstrated both safety and efficacy in clinical testing. According to reports, individuals who received the Covid-19 vaccination exhibited diverse adverse effects, contingent upon the specific immunizations administered. The adverse events documented in phase III clinical trial data were of a modest nature, including pain at the injection site, weariness, headache, joint and muscular discomfort, as well as fever and chills [77]. The clinical trials of the Covid-19 vaccine have also shown significant side effects, such as paralysis, allergy, and lymphadenopathy [78]. Furthermore, several European nations chose to discontinue the administration of the AstraZeneca vaccination due to its alleged association with the occurrence of blood clots [79]. This phenomenon exacerbates the prevailing lack of trust in the safety of vaccines and the apprehensions surrounding Adverse Events Following Immunization (AEFI). This

factor significantly contributes to vaccine hesitancy on two distinct levels: specific hesitancy towards Covid-19 vaccines and general hesitancy towards vaccines overall [80]. Both forms of hesitancy have been linked to reduced acceptance and uptake of vaccines [63].

Furthermore, it has been found that there is a significant link between an individual's impression of safety and adverse events following immunization, and their likelihood of receiving vaccines, including the seasonal influenza vaccination [23]. The issue of vaccine safety has emerged as a prominent concern surrounding the Covid-19 vaccine, with individuals expressing scepticism over its safety, a sentiment that is also observed towards vaccines in general [4],[6]. The prevailing lack of trust over the safety and AEFI associated with vaccinations, along with insufficiently effective communication strategies, necessitates the need for a comprehensive overhaul of vaccine communication methods.

2.9 MEDICAL MISTRUST AND THE COVID-19 CLINICAL TRIALS

The introduction of COVID-19 vaccines has raised majorconcerns, encompassing several aspects such as the duration required for large-scale vaccine manufacturing, as well as the commencement and conclusion of clinical trials [81]. Moreover, the entities and nations that are engaged in the manufacture contribute to the amplification of public scepticism regarding the safety of vaccines and apprehensions regarding adverse events following immunization. This phenomenon significantly contributes to vaccine hesitancy, manifesting in two distinct forms: hesitancy specifically towards Covid-19 vaccines and hesitancy towards vaccines in

general [26]. Both forms of hesitancy are associated with reduced acceptance and utilization of vaccines. There exists a significant link between an individual's impression of safety and adverse events following immunization, and their likelihood of receiving vaccines, including the seasonal influenza vaccination [23]. The issue of vaccine hesitancy over the safety of the COVID-19 vaccines is a prevalent concern, mirroring the widespread scepticism observed towards vaccines [26].

The prevailing lack of trust in the safety and AEFI associated with vaccinations, along with insufficiently effective communication strategies, necessitates the need for a comprehensive overhaul of vaccine communication methods [23]. In order to enhance public trust in vaccines, it is necessary to modify the cultural context of medicine to effectively convey the advantages and risks associated with vaccines. The credibility and reliability of sources that offer information about vaccines are also harmed by the lack of confidence in the Covid-19 vaccine. This diminishes the significance and efficacy of vaccines [29].

2.10 FACTORS THAT ARE CONTRIBUTING TO COVID-19 VACCINE HESITANCY AMONG TERTIARY STUDENTS.

Tertiary students' reservations regarding the COVID-19 vaccine is influenced by a multitude of factors, reflecting the complexity of perceptions within this demographic. A study highlighted a significant association between perceiving the available vaccines as having low safety and heightened vaccine hesitancy among tertiary students [82]. This underscores the pivotal role safety concerns play in

shaping attitudes towards vaccination. Age, previous COVID-19 infection, influenza vaccination status, and race/ethnicity emerged as additional factors influencing vaccine hesitancy among college students [83]. The diversity of these factors suggests the need for tailored interventions that take into consideration the unique circumstances and backgrounds of individual students. Moreover, a lack of research, personal beliefs, and knowledge about the vaccine's long-term effects, and concerns about restrictions on social events and travel were identified as contributing reasons for vaccine hesitancy among both university staff and students [84]. These findings emphasize the importance of addressing not only the medical aspects but also the social and lifestyle considerations that influence vaccination decisions within the university community.

Teenagers who were hesitant to get vaccinated had negative views, were female, didn't know much about COVID-19 disease or the vaccines, and got their information from social media [63]. Understanding how social media can change people's views is important for coming up with good communication plans.

Psychological factors, including generalized anxiety, illness anxiety, low confidence, low reward dependence and low collective responsibility were also identified as contributors to vaccine hesitancy [85]. This highlights the interconnectedness of mental health and vaccine acceptance, calling for holistic approaches that address both medical and psychological aspects.

2.11 SUMMARY OF CHAPTER

In conclusion, the multifaceted nature of COVID-19 vaccine hesitancy among tertiary students requires a comprehensive understanding of diverse influences. Tailored strategies encompassing safety assurance, demographic considerations, social and lifestyle impacts, knowledge dissemination, and mental health support are essential for promoting vaccine acceptance within this critical demographic population.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter serves as a roadmap for the empirical investigation conducted in this study, providing a methodical framework to address the research questions and achieve the study's objectives. In this section, the analytical tools, data collection techniques, and research design that were employed to acquire substantial insights are detailed. Methods, data collection tools, and participant selection are meticulously described, emphasising the methodological rigour employed to enhance the study's reliability and validity. The ethical concerns associated with participant confidentiality, informed consent, and data protection are also addressed.

3.2 RESEARCH DESIGN

Research design is the particular process that goes into gathering data, analysing that data, and writing reports [86]. The research adopted a quantitative cross-sectional analytical approach, selected for its efficacy in collecting data from a substantial sample and enabling the generalization of findings to a larger population [86]. Employing a social-ecological model framework, the study investigated multifaceted elements across different levels associated with vaccine hesitancy among student populations concerning COVID-19. This paradigm offers a holistic comprehension of health, highlighting determinants that may impact health outcomes, encompassing individual characteristics, communal dynamics, environmental conditions, social contexts, and political structures. This

methodological choice ensures a deep exploration of the complex interplay of factors influencing students' vaccine hesitancy, contributing to a comprehensive understanding of the phenomenon.

3.3 POPULATION OF THE STUDY

Creswell [86] notes that, a population refers to a group of individuals sharing a common characteristic and subject to investigation in research. In this study, the population comprised undergraduate students at the UNAM's main campus. UNAM, with a presence across 12 campuses nationwide, is organized into four faculties. In the academic year 2023, the university's total enrollment reached approximately 25,164 students, encompassing both undergraduates and postgraduates. The study specifically focused on full-time students at the UNAM Main Campus, which hosts four faculties and accommodates about 11,752 individuals. This includes 8,056 full-time students and 5,772 part-time students. The distribution across faculties is as follows: 1,538 students in Agriculture, Engineering, and Natural Science; 2,209 in Commerce, Management, and Law; 3,153 in Education and Human Science; and 1,156 in Health Science and Veterinary Medicine.

3.4. SAMPLING AND SAMPLE SIZE SELECTION

Sampling can be defined as the process of selecting a smaller group of participants to collect data from in order to infer to a larger population [87]**.** Obtaining data from the entirety of available research poses significant challenges and is deemed

impossible. Consequently, researchers opt to select a representative sample that encapsulates the essential aspects of the entire population [86]. In addition, sampling techniques offer several strategies to reduce the quantity of data gathered by concentrating on data obtained from a subset of individuals rather than the entire population of interest. The present study utilised a stratified random sampling technique in order to maximise the researcher's ability to access a representative sample of students across the different faculties [87]. The faculties were used as the stratification variable with a proportional selection of participants from each faculty. The estimation of the sample size was conducted by employing the Yamane (1967) method, which takes into account the total number of students enrolled at the UNAM main campus in 2023. This estimation was carried out with a confidence level of 95% and a margin of error of 5%. By utilising this formula, proportional data was obtained for each faculty, ensuring a representative sample. Participants of the sampled population were invited verbally through faculty representatives and lecturers in different classrooms anouncements.

n= N/ (1+N (e) 2)

where the sample size is denoted by n, N stands for the population being studied, and e for the margin error (0.05) the final sample size from the formula was 381 which was proportionally distributed fir each faculty as follows:

Faculty Name	**Total No. Fulltime Students**	**Faculty sample size**	**Percentage**

Agriculture, Engineering and Natural Science	1538	73	19%
Commerce Management and Law	2209	104	27%
Education and Human Science	3153	149	39%
Health Science & Vet. Medicines	1156	55	14%
Grand Total	**8056**	**381**	**99%**

3.5. INSTRUMENT FOR DATA COLLECTION

The structured questionnaire developed by the researcher, included closed-ended questions, was used to collect the data (Appendix One). The questionnaire was divided into three distinct components: demographic data, socio-demographic characteristics related to COVID-19 vaccination reluctance, and individual factors influencing COVID-19 vaccine hesitancy among the university student population. Participants self-administered the questionnaire, and the process was expected to take approximately four weeks to complete. The questionnaire consisted of a combination of questions including Dichotomous (Yes/No), Likert Scale type and multi-response type.

3.6. DATA COLLECTION PROCEDURE

The data was obtained from students enrolled at UNAM. Participants were invited through different classrooms announcements and appointments done through lecturers and class representative. The research was conducted within the natural environment of the proposed educational institution, where the researcher carried out data collection. The method employed for data collection in this study involved using a structured self-administered questionnaire. The researcher visited UNAM to obtain a representative sample of students, who were then requested to complete the structured questionnaire. Each faculty was visited in turn and permission to recruit the students was obtained from the faculty management. Students were approached in between their classes for recruitment and those who agreed were given a questionnaire to complete. Informed consent was obtained from all participants, and the data collection process spanned approximately four weeks.

3.7. VALIDITY AND RELIABILITY

Validity, indicating the extent to which a measurement accurately gauges what it intends to measure, was evaluated through face validity, content and construct validity [88]. Reliability, representing the consistency of results across repeated trials, was gauged using internal consistency measures [87]. The details of the application of these concepts are highlighted in the following sub-sections.

3.7.1 Face Validity

Face validity, representing the degree to which a measurement appears to assess the intended construct, was assessed through comprehensive literature review and a pilot study [88]. Subsequently, the questionnaire was refined to enhance its alignment with the research objectives, ensuring that it is understood by the participants and appeared relevant at face value.

3.7.2 Content Validity

Content validity, indicates the extent to which a measurement encompasses all relevant aspects of the targeted construct, was ensured through an exhaustive literature review and supervisor consultations [88]. The research supervisor played a crucial role in evaluating and refining the questionnaire to align it with the research objectives, thus verifying its content validity.

3.7.3 Construct Validity

Construct validity, assessing the extent to which the questionnaire measured the underlying constructs was assessed through a systematic review of the literature, the pilot study feedback, and an assessment by the research supervisor, all contributing to the establishment of construct validity [87]. This involved examining the relationships between the questionnaire items and the underlying constructs to establish the instrument's construct validity [88].

3.7.4 Reliability

Reliability, represents the consistency of measurement outcomes across repeated trials, was assessed using internal consistency measures [87]. Cronbach's alpha, a

commonly used statistical metric for evaluating the internal consistency of a group of questionnaire items, was employed in the study [88]. The Cronbach's alpha was calculated, resulting in a reliability coefficient of 0.71, signifying greater internal consistency, and a reliable instrument for capturing the intended variables [87].

3.8 DATA ANALYSIS

Data was collected over a period of four weeks whereby a total of 381 questionnaires were distributed across the four faculties at UNAM's main campus. Of these questionnaires, a total of 331 were received back and subsequently used for data analysis, representing a response rate of 86.9%. This was a high response rate which was above the recommended response rate from other studies, minimising potential biases of non-response [89],[90]. All questionnaires were checked for completion and captured using SPSS version 27 for data analysis as described in the previous chapter. The results were presented in the following format: univariate, bivariate and multivariate analysis.

To achieve the goals of the study, a number of steps were necessary in the data analysis technique. We started the process by making sure the surveys were completed completely. We then conducted the research using SPSS version 27.

In order to identify patterns and trends, univariate analysis distilled the data and presented the group's characteristics through variable frequencies and percentages. Using descriptive statistics, this was discovered. Reluctance to get immunised and vaccination status were the main results of a bivariate study using contingency tables. To determine the significance of the factor relationships, inferential statistics

like the Chi-Squared and Fisher's Exact tests were employed. In order to determine whether there was a relationship between individuals who were reluctant to get a vaccine, those who had already had one, and other socioeconomic factors, this study was conducted.

To find out what factors affect UNAM students' decisions to get a vaccine or not, the researchers employed logistic regression and multivariate analysis. Using odds ratios and confidence intervals, the results might be explained. $\alpha=0.05$ was the significance level for logistic regression and other inferential tests.

3.9 ETHICAL CONSIDERATIONS

The consideration of ethical principles in research ensures the protection of participants, uphold research integrity, and foster responsible conduct [87]. By adhering to ethical norms, this study aims to contribute knowledge ethically, fostering trust in the research process and maintaining the well-being of the participants involved. Various ethical principles were applied as highlighted in the following sections.

3.9.1 Permission to conduct research.

To assure compliance with the ethical norms of research, ethical clearance for the study was sought from the UNAM School of Nursing and Public Health Decentralized Research Ethics Committee (SONPH-DEC) (Appendix two). The researcher obtained permission from the appropriate authorities, including the Campus Director, the Head of Department (HOD) for academic affairs, and

HOD/Coordinators for specific schools and departments. Before data collection, all participants were provided with informed consent (Appendix three), ensuring that they were fully aware of their right to withdraw from the study at any point without facing any negative repercussions [87].

3.9.2 Principles of respect

The researcher effectively communicated the study's objectives to the participants, ensuring that they were adequately informed to make an educated choice on their involvement in the research. The need for voluntary involvement was underscored, and no coercive measures were taken to ensure compliance. Participants were provided with the assurance that their names would be handled with utmost confidentiality and that their trust would not be misused for personal advantage or benefit. The idea of autonomy was upheld, and participants were granted the liberty to exercise their discretion in determining whether or not to provide certain information [87].

3.9.3 Principle of Beneficence and Non-maleficence

The research study did not involve any inquiries that could potentially cause injury, and no physical interventions were used on the respondents in order to achieve the objective outcomes of the study. The researcher took measures to ensure that the advantages of the study surpassed any potential hazards to the participants. The confidentiality of all obtained data was ensured, and no information that may potentially cause harm was shared with any external entities [87].

3.9.4 Principle of justice

The participants for the research project were selected randomly, ensuring that each subject from the research population had an equal opportunity to participate. The researcher took measures to prevent the exploitation of vulnerable populations and to ensure equitable and respectful treatment of all participants. Efforts were undertaken to mitigate potential bias or discrimination, and measures were implemented to guarantee that the sample accurately reflects the population under investigation [87].

3.10 SUMMARY OF CHAPTER

The methodology chapter in this research thesis explained the quantitative cross-sectional analytical approach employing a social-ecological model framework. The study focused on COVID-19 vaccine hesitancy among UNAM students, utilizing a structured self-administered questionnaire. Data collection, conducted within the university's natural environment, spanned four weeks. Statistical analyses involved univariate and bivariate analyses, employing descriptive statistics, contingency tables, and inferential statistics like Chi-Squared and Fisher's Exact tests. Multivariate analysis included logistic regression to explore predictors of vaccination and hesitancy. The alpha level for inferential analyses was set at $p=0.05$, ensuring a comprehensive exploration of factors influencing vaccine-related attitudes among students. In the next chapter, the results are presented.

CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

This chapter presents the outcomes of a comprehensive survey conducted across four academic faculties at the UNAM. The research sought to examine the elements influencing Covid-19 inoculation and vaccine reluctance among the student population at UNAM's primary campus located in Namibia's Khomas Region.

4.2 DEMOGRAPHIC CHARACTERISTICS

The participants were asked to indicate their demographic characteristics including age, gender, and the faculty where they are registered for their study programme. The results are shown in the following subsections.

4.2.1 Participant's Age

The majority of the participants were aged between 17 and 25 years (91.5%) with only 0.6% (n=2) aged 36 years and above as shown in Table 1.

Table 1: Participant's Age

Age category	Frequency	Percent	Valid Percent
17-25	303	91.5	93.2
26-35	20	6.0	6.2
36 and above	2	0.6	0.6
Sub-Total	325	98.2	100.0
No response	6	1.8	

Total	331	100.0	

4.2.2 Participant's Gender

Most of the participants were female (62%) with 32% (n=106) males. Seven indicated other gender while 13 did not answer the question.

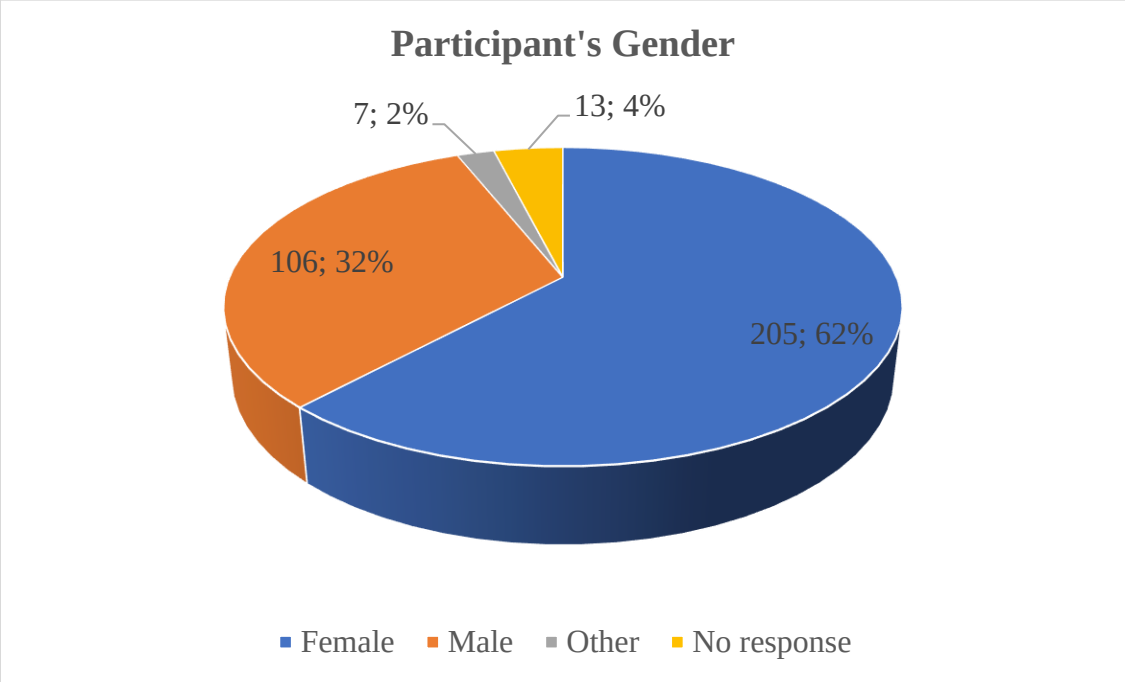

Figure 1: Participant's Gender

4.2.3 Faculty participation

Faculty of education contributed the majority of the participants in this study (39%) followed by faculty of engineering and commerce each with 23%. The faculty of health sciences and veterinary medicine had the least number of participants (15%).

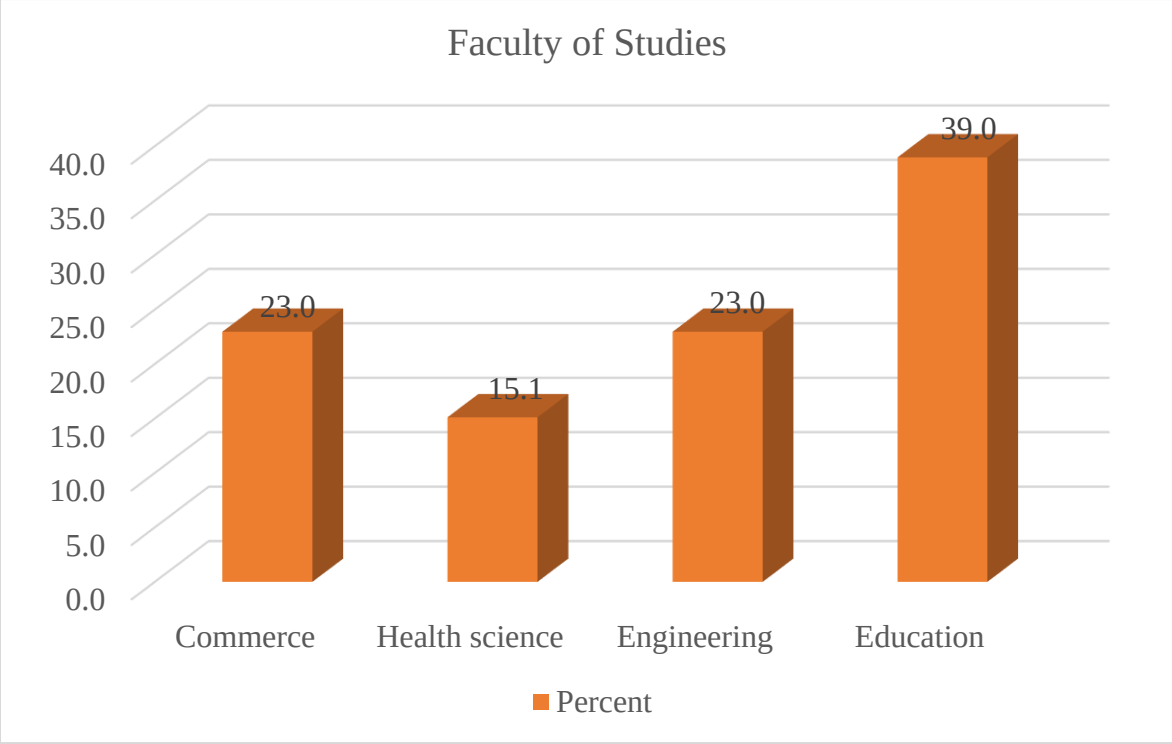

Figure 2: Faculty of studies

4.3 PARTICIPANT'S VACCINATION STATUS

Participants were asked to indicate if they have been vaccinated and the results are shown in the table below.

Table 2: Participants' vaccination status

Vaccination status	Frequency	Percent
Yes	80	24.2
No	250	75.5
No response	1	0.3
Total	331	100.0

Most of the participants (75.5%) were not vaccinated against Covid-19, with only 24.2% having been vaccinated.

4.4 PARTICIPANT'S VACCINATION HESITANCY

All participants were asked to indicate if they feel hesitant to get vaccinated and their responses are shown in the table below.

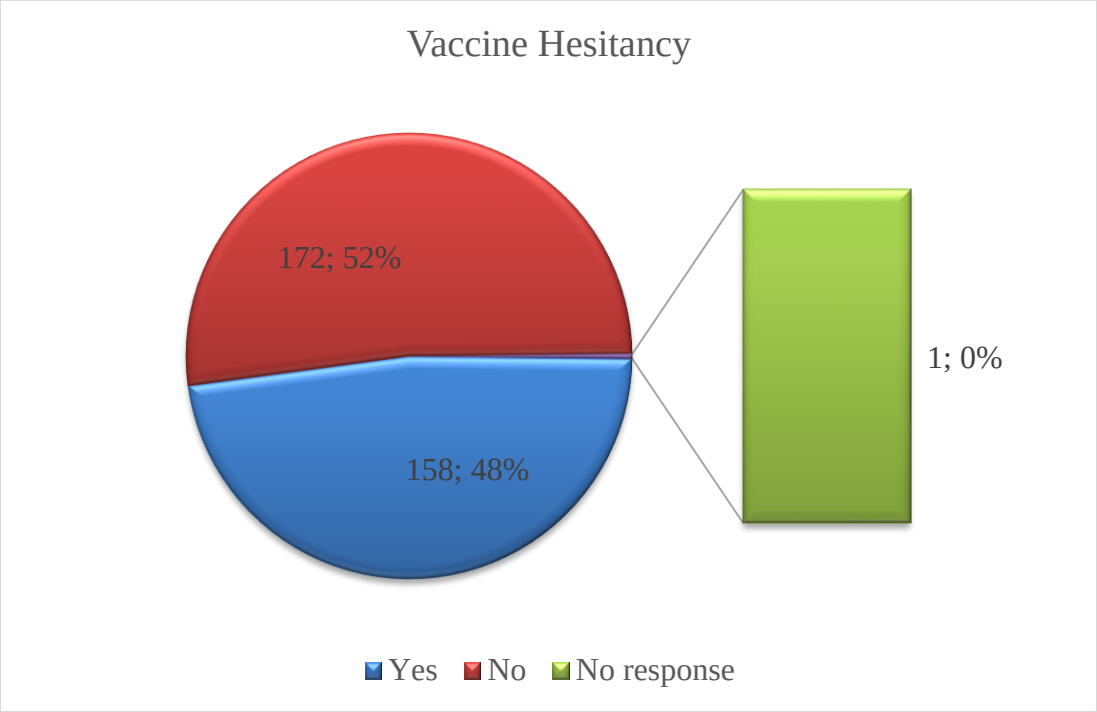

Figure 3: Participants' vaccination hesitancy

A slightly higher proportion (52%) indicated no vaccine hesitancy while 158 (48%) showed hesitancy to be vaccinated as shown in Figure 3

4.5 PARTICIPANTS' REASONS FOR VACCINE HESITANCY

Table 3: Vaccine hesitancy reasons

Reason for hesitancy	Yes n (%)	No n (%)
Concerns about safety	59 (17.8%)	272 (82.2%)
Concerns about effectiveness	41 (12.4%)	290 (87.6%)
Concerns about side effects	109 (32.9%)	222 (67.1%)
Lack of trust in vaccine development	62 (18.7%)	269 (81.3%)
Lack of trust in healthcare providers	22 (6.6%)	269 (81.3%)
Political influences	29 (8.8%)	302 (91.2%)
Other	9 (2.7%)	322 (97.3%)

Among the reasons provided for vaccine hesitancy, the most common was apprehension about adverse effects, reported by 32.9% of respondents. This was followed by skepticism regarding vaccine development processes (18.7%) and worries about overall safety (17.8%). Additional findings are presented in Table 3.

4.6 EXPOSURE TO COVID-19 MYTHS AND MISINFORMATION

Participants were asked to indicate if they have encountered myths or misinformation regarding Covid-19 and their responses are shown in the Figure below.

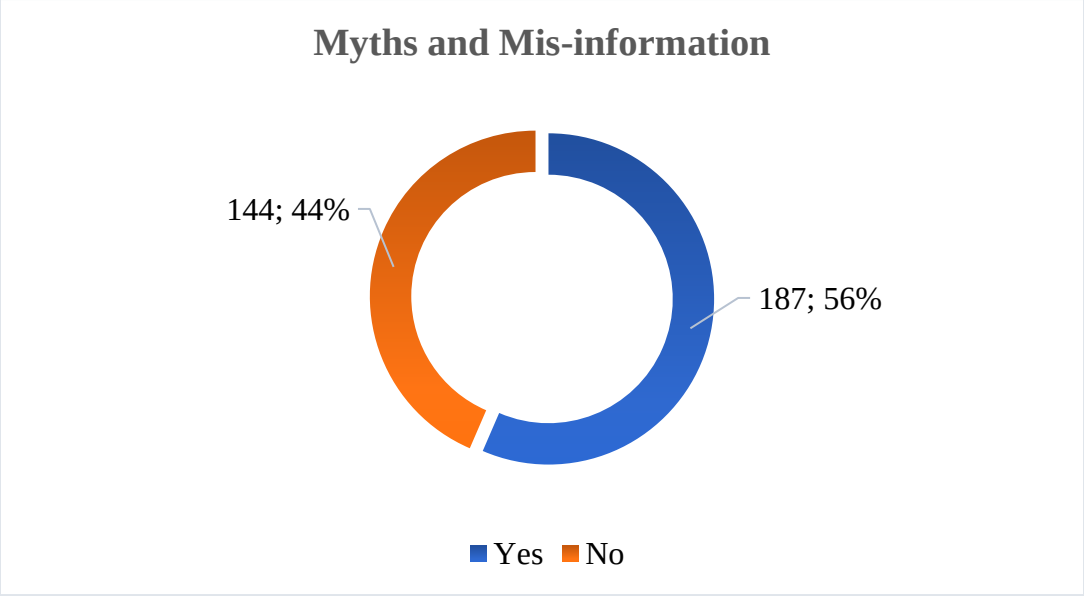

Figure 4: Exposure to Covid-19 myths and misinformation

A higher percentage of participants (56%) indicated that they had encountered myths and misinformation about Covid-19 with 44% indicating the contrary.

4.7 SOURCES OF PARTICIPANTS' COVID-19 INFORMATION

Table 4: Sources of Covid-19 information

Source of information	Yes n (%)	No n (%)	Total n (%)
Internet	232 (70.1%)	99 (29.9%)	331 (100.0%)
Doctor/healthcare provider	141 (42.6%)	190 (57.4%)	331 (100.0%)
Family members	106 (32.0%)	225 (68.0%)	331 (100.0%)
Brochures/pamphlets	68 (20.5%)	263 (79.5%)	331 (100.0%)
Friends/coworkers	74 (22.4%)	257 (77.6%)	331 (100.0%)

Other	11 (3.3%)	320 (96.7%)	331 (100.0%)

The majority of the participants relied upon information obtained from the internet (70.1%), followed by information from their doctor or other healthcare provider (42.6%) and family members (32%). The rest of the sources of information are shown in Table 4.

4.8 USEFULNESS OF INFORMATION SOURCES IN DECISION-MAKING

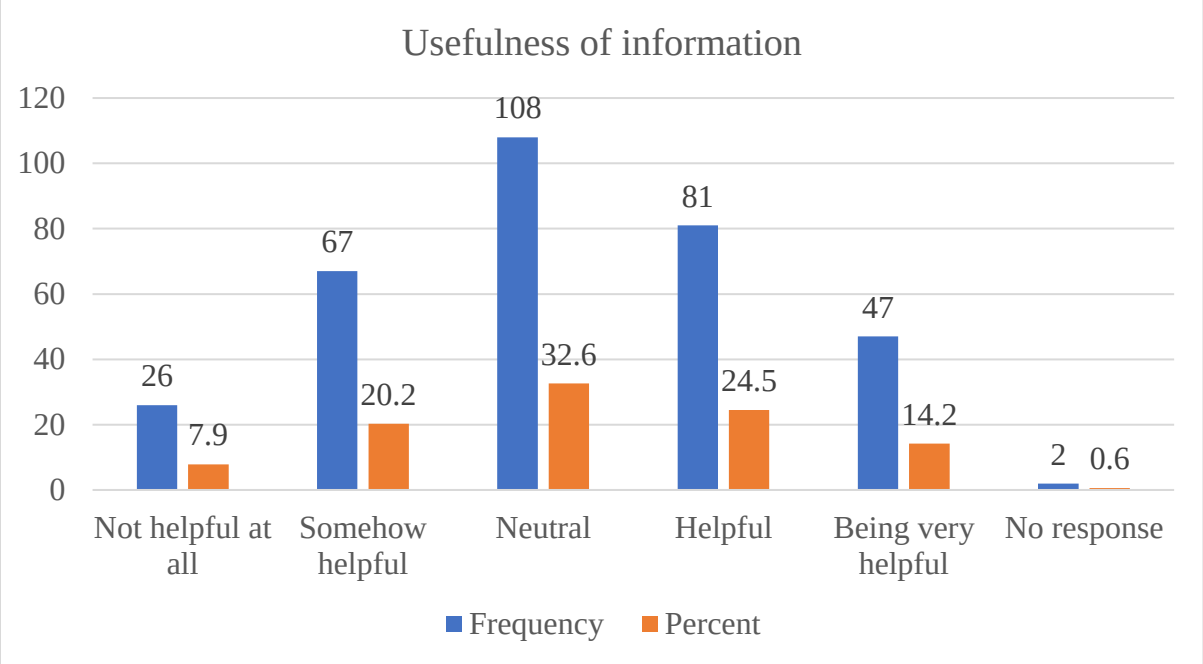

Figure 5: Usefulness of information sources in decision making

The majority of participants indicated neutral (32.6%), showing that they could not rate the usefulness of the information on decision-making. A total of 24.5%

indicated that the information was helpful while 20.2% said it was somehow helpful. A few (7.9%) indicated that the information sources were not helpful at all.

4.9 PARTICIPANTS' CONFIDENCE IN COVID-19 VACCINE SAFETY AND EFFECTIVENESS

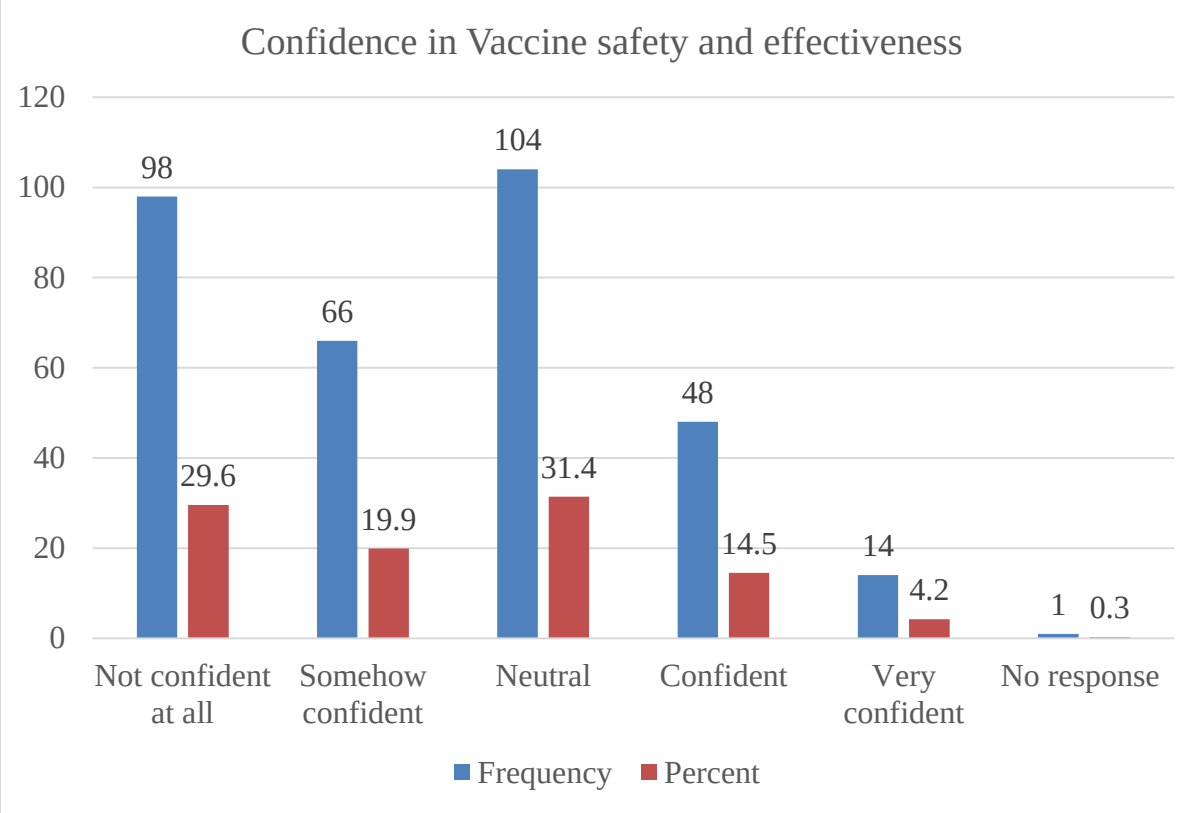

Figure 6: Confidence in COVID-19 vaccine safety and effectiveness

Most of the respondents, 31.4%, were neutral in their confidence level in the safety and effectiveness of the Covid-19 vaccine. This was followed by 29.6% who showed no confidence at all, while 19.9% indicated that they are somehow confident. Only 4.2% were very confident about the safety and effectiveness of the vaccine.

4.10 Participants' beliefs on vaccine importance

Table 5: Vaccine importance beliefs

Questions	Important		No response n (%)	Total n (%)
	Yes n (%)	No n (%)		
Do you believe that receiving the COVID-19 vaccine is important for public health?	165 (49.8%)	161 (48.6%)	5 (1.5%)	331 (100.0%
Do you believe that receiving the COVID-19 vaccine is important for your personal health?	116 (35%)	210 (63.4%)	5 (1.5%)	331 (100.0%

Almost an equal number of participants indicated the vaccine was important (49.8%) and not important (48.6%) for public health. In terms of personal health, the majority believed in was not important (63.4%) as shown in Table 5.

4.11 FACTORS ASSOCIATED WITH VACCINATION STATUS

4.11.1 Participants vaccination status and demographic characteristics

Table 6: Association between vaccination status and demographic characteristics

Variable	Indicators	Vaccination Status		p-value
		Yes n (%)	No n (%)	
Participant's Age	17-25 years	71 (23.5%)	231 (76.5%)	0.084
	26-35 years	5 (25.0%)	15 (75.0%)	
	36 and above	2 (100%)	0 (0.0%)	
Participant's Gender	Female	48 (23.5%)	156 (76.5%)	0.466
	Male	27 (25.5%)	79 (74.5%)	
	Other	3 (42.9%)	4 (57.1%)	
Faculty of studies	Commerce	29 (38.2%)	47 (61.8%)	0.017
	Health Sciences	10 (20.4%)	39 (79.6%)	
	Engineering	17 (22.4%)	59 (77.6%)	
	Education	24 (18.6%)	105 (81.4%)	
Vaccine Hesitancy	Yes	15 (9.6%)	142 (90.4%)	0.001
	No	65 (37.8%)	107 (62.2%)	

Participant's age did not show a significant association with the vaccination status (p=0.084), however, more of the 17–25-year-old participants were vaccinated. Regarding gender, more females than males were vaccinated but this difference was not statistically significant (p=0.466). A higher percentage of participants from the faculty of commerce were vaccinated (38.2%) compared to other faculties with a significant association recorded between the faculty of studies and vaccination status (p= 0.017). Vaccine hesitancy was significantly associated with vaccination status (p=0.001), with more participants being unvaccinated.

4.11.2 Participants Vaccination status and vaccine hesitancy factors

Factors indicated as contributing to vaccine hesitancy were analysed to check their association with actual vaccination status as shown in Table 7.

Table 7: Association between vaccination status and vaccine hesitancy factors

Variable	Indicators		Vaccination Status		p-value
			Yes n (%)	No n (%)	
Reasons for being hesitant	Concerns about safety	Yes	5 (8.5 %)	54 (91.5 %)	0.001
		No	75 (27.7 %)	196 (72.3 %)	
	Concerns about effectiveness	Yes	5 (12.2)	36 (87.8)	0.078
		No	75 (26.0 %)	214 (74.0 %)	

	Concerns about side effects	Yes	9 (8.3 %)	99 (91.7 %)	0.001
		No	71 (32.0 %)	151 (68.0 %)	
	Lack of trust in vaccine development	Yes	8 (12.9 %)	54 (87.1 %)	0.021
		No	72 (26.9 %)	196 (73.1 %)	
	Lack of trust in healthcare providers	Yes	3 (13.6 %)	19 (86.4 %)	0.307
		No	77 (25.0 %)	231 (75.0 %)	
	Political influences	Yes	4 (13.8 %)	25 (86.3 %)	0.185
		No	76 (25.2 %)	225 (74.8 %)	
	Other	Yes	0 (0.0 %)	9 (100.0%)	0.087
		No	80 (24.9 %)	241 (75.1 %)	
Exposure to Covid-19 myths and misinformation		Yes	59 (31.6 %)	128 (68.4 %)	0.001
		No	21 (14.7 %)	122 (85.3 %)	

The vaccination status of participants was significantly linked to several hesitancy factors, including safety worries (p=0.001), apprehensions about adverse effects (p=0.001), and skepticism regarding vaccine development (p=0.021). Additionally, a significant correlation was found between participants' exposure to Covid-19 myths and misinformation and their Covid-19 vaccination status (p=0.001).

4.11.3 Participants Vaccination status and source of Covid-19 information

Table 8: Association between vaccination status and source of Covid-19 information

Variable	Indicators		Vaccination Status		p-value
			Yes n (%)	No n (%)	
Source of Information	Internet	Yes	53 (22.8%)	179 (77.2%)	0.400
		No	27 (27.6%)	71 (72.4%)	
	Doctor/healthcare provider	Yes	46 (32.9%)	94 (67.1%)	0.003
		No	34 (17.9%)	156 (82.1%)	
	Family members	Yes	30 (28.3%)	476 (71.7%)	0.271
		No	50 (22.3%)	174 (77.7%)	
	Brochures/pamphlets Internet	Yes	17 (25.0%)	51 (75.0%)	0.875

		No	63 (24.0 %)	199 (76.0 %)	
	Friends/coworkers	Yes	18 (24.3 %)	56 (75.7 %)	0.985
		No	62 (24.2 %)	194 (75.8 %)	
	Other	Yes	4 (36.4 %)	7 (63.6 %)	0.472
		No	76 (23.8 %)	243 (76.2 %)	

Regarding the source of Covid-19 information, only information from a doctor or healthcare provider showed a significant association with vaccination status (p=0.003). All the other sources of information were not significantly associated with vaccination status.

4.11.4 Participants' vaccination status and attitudes

The attitude of participants on the importance of vaccination was analysed for association with vaccination status as shown in Table 9.

Table 9: Association between participants' vaccination status and Attitudes

Variable	Indicators		Vaccination Status		p-value
			Yes n (%)	No n (%)	
Attitude	Do you believe that receiving the COVID-19	Yes	59 (35.8 %)	106 (64.2 %)	0.001

	vaccine is important for public health?	No	18 (11.3 %)	142 (88.8 %)	
	Do you believe that receiving the COVID-19 vaccine is important for your personal health?	Yes	54 (46.6 %)	62 (53.4 %)	0.001
		No	23 (11.0 %)	186 (89.0 %)	

Both the belief that the vaccine is important for public health (p= 0.001) and personal health (p=0.001) were significantly associated with the vaccination status of the participants.

4.12 FACTORS ASSOCIATED WITH VACCINE HESITANCY

4.12.1 Participants vaccine hesitancy and demographic characteristics

Table 10: Association between vaccine hesitancy and demographic characteristics

Variable	Indicators	Vaccine Hesitancy		p-value
		Yes n (%)	No n (%)	
Participant's Age	17-25 years	147 (48.7%)	155 (51.3%)	0.364
	26-35 years	8 (40.0%)	12 (60.0%)	
	36 and above	0 (0.0%)	2 (100.0%)	
Participant's Gender	Female	111 (54.4%)	93 (45.6%)	0.003

	Male	37 (34.9%)	69 (65.1%)	
	Other	4 (57.1%)	3 (42.9%)	
Faculty of studies	Commerce	39 (52.0%)	36 (48.0%)	0.004
	Health Sciences	34 (68.0%)	16 (32.0%)	
	Engineering	28 (36.8%)	48 (63.2%)	
	Education	57 (44.2%)	72 (55.8%)	

Participant's gender was significantly associated with vaccine hesitancy (p=0.003), where more females (54.4%) than males (34.9%) reported vaccine hesitancy. In addition, the faculty of studies was also significantly associated with vaccine hesitancy (p=0.004), with more participants from the faculty of health science reporting vaccine hesitancy (68.0%).

4.12.2 Participants' vaccine hesitancy and possible factors

Table 11: Association between vaccine hesitancy and possible factors

Variable	**Indicators**		**Vaccine Hesitancy**		**p-value**
			Yes n (%)	**No n (%)**	
Reasons for being hesitant	Concerns about safety	Yes	47 (79.7%)	12 (20.3%)	0.001
		No	111 (41.0%)	160 (59.0%)	

	Concerns about effectiveness	Yes	35 (85.4 %)	6 (14.6 %)	0.001
		No	123 (42.6 %)	166 (57.4 %)	
	Concerns about side effects	Yes	87 (79.8 %)	22 (20.2 %)	0.001
		No	71 (32.1 %)	150 (67.9 %)	
	Lack of trust in vaccine development	Yes	44 (71.0 %)	18 (29.0 %)	0.001
		No	114 (42.5 %)	154 (57.5 %)	
	Lack of trust in healthcare providers	Yes	19 (86.4 %)	3 (13.6 %)	0.001
		No	139 (45.1 %)	169 (54.9 %)	
	Political influences	Yes	23 (79.3 %)	6 (20.7 %)	0.001
		No	135 (44.9 %)	166 (55.1 %)	
	Other	Yes	8 (88.9 %)	1 (11.1 %)	0.016
		No	150 (46.7 %)	171 (53.3 %)	
Exposure to COVID-19 myths and misinformation		Yes	92 (49.2 %)	95 (50.8 %)	0.657

	No	66 (46.2 %)	77 (53.8 %)	

Vaccine hesitancy was found to be significantly linked to several factors, including apprehensions about safety (p=0.001), efficacy (p=0.001), and adverse reactions (p=0.001). Additionally, distrust in the vaccine development process (p=0.001) and healthcare professionals (p=0.001), as well as political factors (p=0.001) and other elements (p=0.016), showed significant associations. Interestingly, no substantial connection was observed between exposure to COVID-19 myths and misinformation and reluctance to vaccinate (p=0.657).

4.12.3 Participants vaccine hesitancy and source of COVID-19 information

Table 12: Association between vaccine hesitancy and source of Covid-19 information

Variable	Indicators		Vaccine Hesitancy		p-value
			Yes n (%)	No n (%)	
Source of Information	Internet	Yes	116 (50.0 %)	116 (50.0 %)	0.278
		No	42 (42.9 %)	56 (57.1 %)	
	Doctor/healthcare provider	Yes	63 (45.0 %)	77 (55.0 %)	0.375
		No	95 (50.0 %)	95 (50.0 %)	

	Family members	Yes	51 (48.6%)	54 (51.4%)	0.906
		No	107 (47.6%)	118 (52.4%)	
	Brochures/pamphlets Internet	Yes	27 (39.7%)	41 (60.3%)	0.137
		No	131 (50.0%)	131 (50.0%)	
	Friends/coworkers	Yes	43 (58.9%)	30 (41.1%)	0.035
		No	115 (44.7%)	142 (55.3%)	
	Other	Yes	6 (54.5%)	5 (45.5%)	0.763
		No	152 (47.6%)	167 (52.4%)	

Only information obtained from friends or coworkers showed a significant association with vaccine hesitancy (p=0.035), with a higher percentage of those who relied on this source of information (58.9%) indicating vaccine hesitancy. All other sources of information were not significantly associated with vaccine hesitancy as shown in Table 12.

4.12.4 Participants vaccine hesitancy and their attitudes

Table 13: Association between vaccine hesitancy and participants' attitudes

Variable	Indicators		Vaccine Hesitancy		p-value
			Yes n (%)	No n (%)	
Attitude statement	Do you believe that receiving the COVID-19 vaccine is important for public health?	Yes	61 (37.2 %)	103 (62.8 %)	0.001
		No	96 (59.6 %)	65 (40.4 %)	
	Do you believe that receiving the COVID-19 vaccine is important for your personal health?	Yes	30 (25.9 %)	86 (74.1 %)	0.001
		No	127 (60.8 %)	82 (39.2 %)	

Both the belief that the vaccine is important for public health (p= 0.001) and personal health (p=0.001) were significantly associated with vaccine hesitancy of the participants.

4.13 REGRESSION TO DETERMINE PREDICTORS OF VACCINATION

Table 14: Predictors of vaccination status

Variables	B	Wald		Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Participant's Faculty		9.963		0.019			
Participant's Faculty Health Sciences	-0.814	2.669		0.102	0.443	0.167	1.176
Participant's Faculty Engineering	-1.018	5.652		**0.017**	**0.361**	**0.156**	**0.836**
Participant's Faculty Education	-1.136	8.871		**0.003**	**0.321**	**0.152**	**0.678**
Concerns about safety	-0.937	2.977		0.084	0.392	0.135	1.136

Are you hesitant to receive the COVID-19 vaccine	-1.758	24.965		**0.000**	**0.172**	**0.086**	**0.343**
lack of trust in Vaccine development	-0.253	0.309		0.578	0.777	0.319	1.893
Have you been exposed to any myths or misinformation about the COVID-19 vaccine	1.138	12.733		**0.000**	**3.121**	**1.670**	**5.831**
Doctor/ healthcare provider	0.740	5.782		**0.016**	**2.095**	**1.147**	**3.828**
Constant	-0.619	2.314		0.128	0.539		

The logistic regression model shows the likelihood of participants being vaccinated against COVID-19 given the various covariates. The logistic regression analysis yielded statistically significant results, with X2(8) = 77.40 and p = 0.0001. The model accounted for 31.3% of the variation in vaccination status (Nagelkerke R2) and accurately categorized 81.8% of the cases. The findings indicated that students in the engineering faculty (OR=0.361: CI;0.156-0.836) and education faculty (OR=0.321: CI;0.152-0.678) were less likely to be vaccinated. Additionally,

individuals exhibiting vaccine hesitancy had lower odds of receiving the vaccine (OR=0.172: CI;0.086-0.3431).

4.14 REGRESSION TO DETERMINE PREDICTORS OF VACCINE HESITANCY

Table 15: Predictors of vaccine hesitancy

Variables	**B**	**Wald**		**Sig.**	**Exp(B)**	**95% C.I. for EXP(B)**	
						Lower	**Upper**
Participant's Gender		7.067		0.029			
Participant's male	-0.658	4.006		**0.045**	**0.518**	**0.272**	**0.986**
Participant's other	1.316	2.135		0.144	3.730	0.638	21.802
Participant's Faculty		7.014		0.0			

				71			
Participant's Faculty Health Sciences	-0.306	0.351		0.554	0.736	0.267	2.029
Participant's Faculty Engineering	-0.782	2.946		0.086	0.457	0.187	1.117
Participant's Faculty Education	-1.004	6.131		**0.013**	**0.366**	**0.166**	**0.811**
Concerns about safety	1.187	7.519		**0.006**	**3.278**	**1.403**	**7.659**
Concerns about effectiveness	0.761	1.538		0.215	2.141	0.643	7.129
Concerns about side effects	1.998	32.478		**0.000**	**7.374**	**3.709**	**14.658**
lack of trust in Vaccine development	0.455	1.128		0.288	1.577	0.681	3.652
Lack of trust in healthcare providers	1.2	1.956		0.1	3.381	0.6	18.6

	1 8			6 2		1 3	3 4
Political influence	0. 1 3 1	0.035		0. 8 5 1	1.1 40	0 . 2 9 0	4. 4 8 8
Other	2. 9 5 4	6.723		**0. 0 1 0**	**19. 18 8**	**2 . 0 5 7**	**1 7 8. 9 9 2**
Friends/ coworkers	0. 1 8 2	0.232		0. 6 3 0	1.2 00	0 . 5 7 1	2. 5 1 9
Do you believe that receiving the COVID-19 vaccine is important to public health	- 0. 2 5 9	0.454		0. 5 0 0	0.7 72	0 . 3 6 4	1. 6 3 8
Do you believe that receiving the COVID-19 vaccine is important for your personal health	- 0. 7 5 4	3.414		0. 0 6 5	0.4 71	0 . 2 1 1	1. 0 4 7
Constant	0. 0 3 2	0.006		0. 9 4 1	1.0 33		

The logistic regression analysis reveals the probability of participants exhibiting vaccine hesitancy based on various factors. The model proved statistically significant, X2(15) = 132.01, p= 0.001, accounting for 46% of the variance in vaccine hesitancy (Nagelkerke R2) and accurately classifying 80.8% of cases. Findings indicate that men were less likely to display vaccine hesitancy compared to women (OR=0.518: CI;0.272-0.986). Additionally, individuals from the education faculty showed a reduced probability of vaccine hesitancy (OR=0.322: CI;0.166-0.811). In contrast, participants expressing concerns about safety (OR=3.278: CI;1.403-7.659), side effects (OR=7.374: CI;3.709-14.658), and other issues (OR=19.188: CI;2.057-178.992) demonstrated an increased likelihood of vaccine hesitancy.

4.15 SUMMARY OF CHAPTER

This chapter presents all the results of the study. Univariate and bivariate analyses were conducted to determine the prevalence of vaccination and vaccine hesitancy. Factors associated with both vaccination and vaccine hesitancy were explored using Chi-squared and Fisher's Exact tests where applicable followed by binary logistic regression. All significant associations were identified at an alpha level of 0.05. The next chapter will discuss the results in the context of what is already known in the literature.

CHAPTER FIVE

DISCUSSION, CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, the outcomes presented in Chapter Four are discussed in the context of the existing literature and their significance. Both primary and secondary literature are utilized to impart meaning and understanding regarding the relevance of the findings. The researcher, using her contextual knowledge, adds value and richness to the discussion. The discussion is structured using the study objectives. This organized approach facilitates a comprehensive exploration of the results, aligning them with established literature and offering a detailed perspective on the implications of the study.

5.2 DISCUSSION OF FINDINGS

5.2.1 Demographic characteristics

The majority of participants in this study were young, with 93.2% below the age of 25, aligning with the typical age range of university students who are transitioning from adolescence to adulthood. This period marks a phase where individuals start taking responsibility and exercising autonomy in decision-making [91],[92]. Consequently, these students were considered old enough to make decisions regarding receiving the Covid-19 vaccine. Age, however, did not exhibit any association with vaccination status or vaccine hesitancy, rendering it a non-predictor in this study. The results of this study diverge from earlier research that found older

individuals in the United States were more prone to vaccine hesitancy [24]. Interestingly, these findings also differ from another study which suggested that young adults over 15 years old exhibited vaccine hesitancy [93]. Regarding gender distribution, the majority of participants were female, with a small number identifying as other or not responding. This aligns with Namibia's gender demographics and UNAM's enrollment quotas, where female students predominate [94],[95]. Although gender was not linked to vaccination status in this study, it showed a significant correlation with vaccine hesitancy ($p=0.003$), with females displaying greater hesitancy than males. This observation is consistent with existing literature, which indicates that women are generally more reluctant to receive vaccines compared to men. A study in Europe revealed that women were more likely to express hesitancy or refuse COVID-19 vaccination than men [96]. Additionally, a systematic review and meta-analysis concluded that males generally had a higher intention to receive the Covid-19 vaccine than females [97]. Consequently, it is crucial to address the concerns and fears expressed by females to reduce vaccine hesitancy and increase both the intention to vaccinate and actual vaccination rates.

The majority of participants (39%) were from the faculty of education, which also has the highest student enrollment at UNAM. A significant association was found between participants' faculty and both vaccination status and vaccine hesitancy, suggesting disparities in information levels or access across different faculties. Education type and level have been identified in the literature as the most significant factors influencing vaccination and vaccine hesitancy [98]. For instance, a study conducted among health science students in Ethiopia found that graduating class

and senior students were more likely to accept vaccination compared to freshman-year students. Despite most students having a positive attitude towards the vaccine, a considerable proportion still hesitated to receive it [99]. Educational institutions, such as UNAM, should adopt strategies ensuring equitable information access across faculties, particularly during pandemics like COVID-19, to facilitate informed decision-making among students.

5.2.2 Objective 1: Determine prevalence of vaccination and associated factors among students at the University of Namibia

This study reported a lower Covid-19 vaccination rate of 24.2%, with the majority of participants being unvaccinated. The vaccination rate was very low compared to other universities in literature though the vaccination rate shows variation across the geographical locations and studies. For instance, a study in Albania showcased a considerably higher vaccination rate of 88% among students [100]. Similarly, the University of San Francisco reported an impressive vaccination rate exceeding 82%, attributing it to the implementation of university-mandated vaccination policies [101]. In Turkey, another study indicated a vaccine intent of 54.1% among students [102]. These divergent findings underscore the influence of factors such as vaccine mandates, intent, and awareness of respiratory infection prevention on the Covid-19 vaccination rate among university students.

Low vaccine uptake in low- to middle-income countries is influenced by factors such as limited availability, access to preferred vaccines, and insufficient information for decision-making [103]. Namibia has faced challenges in vaccine uptake, with rates standing at 6.3% in July 2021 and increasing to 23.8% by June

2022 [38],[104]. This vaccination rate was considered to be very low when compared to the country's target of vaccinating 60% of the population, requiring a comprehensive approach to improve access and information dissemination. The vaccination rates in Namibia and at UNAM reported in this study are also comparatively low when contrasted with other countries globally. South Africa was reported to have the highest vaccination rate in Southern Africa, with a rate of 34.9% by April 2022 [105]. Outside of Africa, vaccination rates were much higher, with India reporting 71.02% while Italy recorded 84.4% in April 2022 [105]. Globally, the United Arab Emirates was reported to have the highest vaccination rate at 98.99%, while the global average was at 60% during the same period [105]. In low-income countries, an average of 15.9% of the population had been vaccinated with at least one dose as of May 2022 [106]. These statistics highlight the persistent challenges faced by African nations, including Namibia, in achieving higher vaccination rates, linked to issues like vaccine procurement, infrastructure limitations, and shortages of healthcare workers [107].

The literature and the present study indicate that COVID-19-related challenges in Namibia contribute to low vaccination rates. Several factors demonstrated a significant association with vaccination status in the current study. Concerns about safety was one of the factors that showed an association with vaccination rates ($p=0.001$). The other factors included concerns about side effects ($p=0.001$), lack of trust in the vaccine development process ($p=0.021$) and exposure to myths and misinformation which all had a negative effect on vaccination rates. However, the belief that the vaccine is important for public ($p=0.001$) and personal health had a

positive effect on vaccination rates. Negative attitude towards the COVID-19 vaccine has been shown to contribute to low vaccination rates in some countries [108].

5.2.3 Objective 2: Determine the factors associated with Covid-19 vaccine hesitancy among students at the University of Namibia.

Vaccine hesitancy, denoting a reluctance to receive approved and recommended vaccines for preventing serious health problems, presents a significant threat to both local communities and global health [25],[26][38]. In the current study, vaccine hesitancy was high at 48% of the participants. This was a holistic assessment regardless of whether one had received a single dose of the vaccine or not. The issue of COVID-19 vaccine hesitancy within university student populations is a global concern, prompting various studies in diverse settings. A comparable study conducted at a midsize midwestern university in Nigeria, encompassing 311 undergraduate and graduate students, echoed the current findings, revealing a 50% hesitancy rate influenced by factors like age, student status, influenza vaccination history, race, earlier COVID-19 infection, and ethnicity [109]. Similarly, research among students in Southern Thailand reported a 50% hesitancy rate among the unvaccinated, emphasizing the significant association between perceived low vaccine safety and heightened hesitancy, while trust in healthcare providers correlated with lower hesitancy [110]. Conversely, a UK university study found a lower hesitancy rate of 20% among students and staff, attributed to concerns about long-term effects, religious and personal beliefs, and constraints on social events and travel [111].

Comparison of the study's findings with those from adolescents and young adults in other countries reveals consistent patterns of variation. Research has shown varying levels of vaccine hesitancy among young people and adolescents across different African regions. For example, rates ranged from 15% in rural Kersa, Ethiopia, to 88% in rural Dodoma, Tanzania. Other notable figures include 31% in rural Nouna, Burkina Faso; and 24% in rural Ibadan, Nigeria [112]. European countries have demonstrated slightly lower vaccine hesitancy, with Turkey reporting 31% and the UK 14%, possibly due to better availability of reliable and authentic information [31]. This study's findings, along with other evidence, indicate that vaccine hesitancy is particularly high among young individuals, including those in higher education who may have greater access to credible information sources. University students are expected to be exemplary influencers in society as they are regarded as knowledgeable and well-informed [38]. In addition, they are expected to be the vehicle of change, both positive attitude and behaviour, as they interact with members of their community aiding in dispelling myths and misinformation in the community regarding vaccination [38]. However, in cases such as the current study where vaccine hesitancy is high, the effects may be the opposite resulting in a compounded increase in hesitancy within the communities. A concerted effort is essential to persuade university students about the necessity and safety of vaccines, both for personal and public health benefits, maximizing their positive impact on the community.

Generally, vaccine hesitancy has been reported to fluctuate over time, especially in lower to middle-income countries, influenced by factors such as access to accurate

information, vaccine availability, and historical attitudes toward vaccines, among others [37]. The reported levels of vaccine hesitancy in this study, though notably high, align with general findings in the existing literature. For instance, South Africa's national Covid-19 vaccine hesitancy averaged 41%, with certain areas such as Nelson Mandela Bay Municipality reporting up to 78.8% hesitancy [30]. In Ghana, vaccine hesitancy exhibited variations across time, being reported at 36.8% in 2020, then decreased to 17.2% in 2021, and then increasing to 52.2% in 2022 [113]. This suggests that vaccine hesitancy is a dynamic measure requiring routine assessment and interventions to manage and control its impact on vaccination rates.

5.2.4 Objective 3: Analyse predictors of Covid-19 vaccination and vaccine hesitancy among students at the University of Namibia

Multiple factors were associated with vaccine hesitancy, the most of which concerned safety. Safety concerns, reported by 17.8% of participants, align with literature citing safety as a primary reason for reduced vaccination rates and increased hesitancy [26],[112]. Furthermore, factors such as concerns about effectiveness (p=0.001), side effects (p=0.001), lack of trust in vaccine development (p=0.001), healthcare providers (p=0.001), political influences (p=0.001), and others (p=0.016) were all significantly linked to vaccine hesitancy. Among these factors, concerns about safety (OR=3.278: CI;1.403-7.659) and concerns about side effects (OR=7.374: CI;3.709-14.658) emerged as significant predictors of vaccine hesitancy. These factors have been identified as huge impediments to vaccine uptake in lower and middle-income countries contributing to higher levels of hesitance [37].

In a recent multi-country study involving healthcare workers across 23 nations in both low and high-income regions, it was noted that vaccine safety, effectiveness, and lack of trust in development strongly correlated with vaccine hesitancy [80]. This hesitancy among healthcare workers could negatively influence community perceptions, potentially affecting patient and family members' vaccine acceptance [80]. A similar effect is anticipated among university students, particularly those in health sciences, who are highly regarded within their communities for their knowledge and decision-making skills. Saudi Arabia reported additional contributors to vaccine hesitancy, such as the fear of the side effects, level of education, and income status [114]. Fear of side effects was also noted as one of the major contributors to hesitancy in a previous systematic review of hesitancy-related factors [106]. It is therefore important that tailored approaches are adopted to communicate vaccine safety and effectiveness to dispel the worries and concerns in the community due to lack of information.

5.3 CONCLUSION

This research aimed to investigate the factors influencing COVID-19 vaccination uptake and hesitancy among students at the University of Namibia's main campus in the Khomas Region. Addressing the first objective, the study found a low overall vaccination rate of 24.2% across various faculties. Significant variables affecting vaccination status included the faculty of study ($p=0.017$), vaccine safety concerns ($p=0.001$), fear of side effects ($p=0.001$), skepticism about vaccine development ($p=0.021$), and exposure to COVID-19 misinformation ($p=0.001$).

The second objective examined factors contributing to vaccine hesitancy. Results showed high hesitancy levels, with 48% of students unwilling to be vaccinated, and female students displaying greater reluctance than males. Key factors significantly associated with hesitancy were gender (p=0.003), faculty of study (p=0.004), safety and efficacy concerns (p=0.001), fear of side effects (p=0.001), distrust in vaccine development (p=0.001), lack of confidence in healthcare providers (p=0.001), political influences (p=0.001), unspecified factors (p=0.016), information from peers (p=0.035), and general vaccination attitudes (p=0.001).

For the third objective, predictors of COVID-19 vaccination and hesitancy were analyzed using multivariable logistic regression. Factors decreasing the likelihood of hesitancy included gender (OR = 0.518; CI: 0.272-0.986) and faculty of studies (OR = 0.322; CI: 0.166-0.811). Factors increasing the odds of hesitancy were safety concerns (OR = 3.278; CI: 1.403-7.659), fear of adverse effects (OR = 7.374; CI: 3.709-14.658), and other pandemic-related concerns (OR = 19.188; CI: 2.057-178.992). These findings highlight the multifaceted nature of vaccine hesitancy and vaccination rates among university students, emphasizing the role of demographic, psychological, and social factors in their vaccination decisions.

5.4 RECOMMENDATIONS

From the study findings, the following are recommendations that are aimed at improving vaccination rates and reducing vaccine hesitancy.

5.4.1 Training Institution

The University of Namibia should implement targeted educational campaigns within each faculty to address concerns related to vaccine safety and side effects. These campaigns can be integrated into existing student programs and should focus on dispelling COVID-19 myths and providing evidence-based information. Additionally, the institution could collaborate with healthcare professionals to conduct workshops on vaccine awareness and its importance in maintaining a safe campus environment.

5.4.2 Policy Makers

Policy makers in Namibia should consider developing and implementing policies that encourage vaccination uptake among students. This could include creating incentives for vaccination, such as access to campus facilities or academic support. Furthermore, addressing concerns about vaccine safety and effectiveness through clear communication strategies is essential for fostering trust and increasing vaccination rates.

5.4.3 Students Community

The student community should actively engage in open dialogues about vaccine hesitancy, utilizing peer-to-peer discussions to address concerns and share accurate information. Encouraging a supportive environment for vaccination through student-led initiatives, events, and awareness campaigns can contribute to changing attitudes and reducing hesitancy. It is crucial for students to stay informed and rely on credible sources for information regarding COVID-19 vaccines.

5.4.4 Research

Future research should focus on continually monitoring vaccine perceptions among students and evaluating the effectiveness of implemented interventions. Collaborative efforts between researchers, healthcare professionals, and community leaders can contribute to a comprehensive understanding of vaccination behaviour among university students in Namibia.

5.5 LIMITATIONS

Although the study aimed for objectivity in measurements, the reliance on a self-reporting tool introduces the potential for self-preservation bias and group-oriented responses. To mitigate these effects, the researcher underscored the importance of participants providing truthful and objective responses. Additionally, assurances of data confidentiality were communicated to participants to encourage openness in their reporting. Another limitation to note is the prior knowledge on myths and misinformation that vaccines work, to a certain extend this can influence the study replies.

5.6 SUMMARY

This chapter discusses the findings of the study, through a literature comparison, revealing both similarities and differences with established knowledge on vaccination and vaccine hesitancy. This research enhances contextual understanding of associated factors, presenting an opportunity for tailored solutions to improve vaccination and reduce hesitancy, not only for COVID-19 but also for future pandemics.

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Appendix One: Research Questionnaire

Research Questionnaire

Title: Factors associated with COVID-19 vaccine hesitancy among students at the University of Namibia, main campus, Khomas region

Researcher: JUSTINE HEITA

The purpose of this study is to assess potential factors associated with COVID-19 vaccine hesitancy amongst higher institution students at university of Namibia main campus. It is completely anonymous, and all responses will be treated with confidentially. The exercise will take about 15 minutes. Thank you for your cooperation.

Please do not write your name on this questionnaire as we wish to retain your anonymity. Check the following items which apply to you: Please mark your appropriate response with an x in the appropriate box with numbers.

Section 1: Demographics

1. Age: ____
2. Gender: Male □ Female □ Other: □
3. Program of Study: ____
4. Current year of study: ____
5. Have you been vaccinated for COVID-19? Yes □ No □

Section 2: COVID-19 Vaccine Hesitancy

1. Are you hesitant to receive the COVID-19 vaccine? Yes □ No □
2. If yes, what are your reasons for being hesitant? (Check all that apply)

- □Concerns about safety
- □Concerns about effectiveness
- □Concerns about side effects
- □Lack of trust in vaccine development
- □Lack of trust in healthcare providers

- □Political influences
- □Other: _____

3. Have you been exposed to any myths or misinformation about the COVID-19 vaccine? Yes □ No □
4. If yes, what myths or misinformation have you been exposed to? (Open-ended response)

……

Section 3: Sources of Information

1. What sources of information have you relied on to learn about the COVID-19 vaccine? (Check all that apply)

- □Internet
- □Doctor/healthcare provider
- □Family members
- □Brochures/pamphlets
- □Friends/coworkers
- □Other: _____

2. How helpful have these sources of information been in informing your decision to receive the COVID-19 vaccine? (1-5 rating scale),

- □Not helpful at all
- □Somehow helpful
- □Neutral
- □Helpful
- □Very helpful

Section 4: Attitudes and Perceptions

1. How confident are you in the safety and effectiveness of the COVID-19 vaccine? (1-5 rating scale)

- □Not confident at all
- □Somehow confident
- □Neutral
- □Confident
- □Very confident

2. Do you believe that receiving the COVID-19 vaccine is important for public health?

Yes □ **No** □

3. Do you believe that receiving the COVID-19 vaccine is important for your personal health? **Yes** □ **No** □

Appendix Two: Ethical Clearance Certificate

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ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: DEC OSH 0064 **Date: 11/09/2023**

This Ethical Clearance Certificate is issued by the University of Namibia Ethics Committee (REC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the ethics committee.

Title of Project: FACTORS ASSOCIATED WITH COVID-19 VACCINE HESITANCY AMONG STUDENTS AT THE UNIVERSITY OF NAMIBIA, MAIN CAMPUS, KHOMAS REGION

Principal researcher: JUSTINE NDAHEPULUKA HEITA

Staff Number/ Student number: 200417541

Remarks: Low Risk Approved

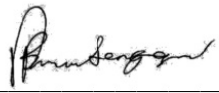
Centre for Research Services

Take note of the following:

1. Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the ethics committee. An application to make amendments may be necessary.
2. Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the ethics committee.
3. The Principal Researcher must report issues of ethical compliance to the ethics committee (through the Chairperson) at the end of the Project or as may be requested by the ethics committee.
4. The ethics committee retains the right to:
   i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
   ii) Request for an ethical compliance report at any point during the course of the research.

The ethics committee wishes you the best in your research.

Prof Hans J Amukugo (Oshakati Campus Chairperson Decentralized Ethics Committee)



Prof. Davis Mumbengegwi (Head, Multidisciplinary Research)

Appendix Three: Informed Consent Form

UREC Annex 5F: Informed Consent
INFORMED CONSENT FORM

Informed Consent for Participants in the Study: Factors Associated with COVID-19 Vaccine Hesitancy among Students at the University of Namibia, Main Campus, Khomas Region

Principal Investigator: Justine Ndahepuluka Heita

Date of Consent: ……..

PART I: INFORMATION SHEET

Introduction:

I am Justine Ndahepuluka Heita, a postgraduate at the University of Namibia. I am conducting a research study titled "Factors Associated with COVID-19 Vaccine Hesitancy among Students at the University of Namibia, Main Campus, Khomas Region." I am inviting you to take part in this research, which aims to understand the reasons behind COVID-19 vaccine hesitancy among students at our university.

Your decision to participate is entirely voluntary. You are not required to decide immediately; you may take time to discuss the research with anyone you trust before making a decision. Please know that you can ask questions at any point during this process.

Purpose of the Research:

The purpose of this study is to gain insights into the factors contributing to COVID-19 vaccine hesitancy among students at the University of Namibia. We aim to explore your attitudes, beliefs, and concerns regarding COVID-19 vaccines and gather information that could help improve public health strategies.

We want to learn about your experiences and perspectives on COVID-19 vaccination to better understand how to address vaccine hesitancy and enhance vaccination efforts in our community.

Type of Research Intervention:

Your participation will involve completing a survey/questionnaire and providing demographic information about yourself. The survey will include questions about your opinions and thoughts related to COVID-19 vaccines. Your responses will help us gain a comprehensive understanding of vaccine hesitancy among students.

Participant Selection:

You have been selected to participate in this research because you are a student at the University of Namibia, Main Campus, and your insights are crucial to

achieving a well-rounded understanding of COVID-19 vaccine hesitancy among our student population.

Voluntary Participation:

Participation in this research is entirely voluntary. You are free to decline participation, and your decision will not affect your academic standing or any services you receive at the university. If you choose to participate, you may withdraw at any time without facing any negative consequences.

Procedures:

For this study, you will be asked to complete a survey/questionnaire that explores your thoughts and opinions about COVID-19 vaccines. The survey will take approximately 20-30 minutes to complete. Your responses will be confidential, and no personally identifiable information will be shared.

Duration:

Participation in the study will require about 10-15 minutes of your time to complete the survey/questionnaire.

Risks:

There are minimal risks associated with participating in this research. Some questions in the survey might touch upon sensitive topics related to COVID-19 and vaccines. However, you are not obligated to answer any question that makes you uncomfortable, and your responses will remain confidential.

Benefits:

Although there are no direct benefits to you as a participant, your contribution will help advance our understanding of vaccine hesitancy and potentially contribute to improved public health strategies.

Confidentiality:

Your responses will be kept confidential, and your data will be stored securely. Your survey responses will be anonymized, and no individual participant will be identifiable in any research reports or publications.

Sharing the Results:

The findings of this research will be shared with you and the university community. A summary of the results will be provided for academic purposes, and we may hold discussions or meetings to share the findings with the university health department.

Right to Refuse or Withdraw:

Participation is entirely voluntary. You have the right to refuse to participate or to withdraw from the study at any point without any negative consequences.

Who to Contact:

If you have any questions about the study or concerns about your rights as a participant, you may contact me, Justine Ndahepuluka Heita, at 0811433444. You

can also reach out to the University of Namibia's Research Ethics Committee at if you have any concerns about your participation please call (+ 264 61) 206 4673 or write an e-mail to research@unam.na.

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it, and I voluntarily consent to be a participant in the study "Factors Associated with COVID-19 Vaccine Hesitancy among Students at the University of Namibia, Main Campus, Khomas Region."

Participant's Name: _____ Participant's Signature:

_____ Date: _____

Researcher's Name: _____ Researcher's Signature:

_____ Date: _____