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Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa

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KNOWLEDGE, ATTITUDES AND BELIEFS OF PHARMACY STUDENTS TOWARDS INFLUENZA VACCINATION IN SOUTH AFRICA



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A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the Master of Pharmacy degree.

Johannesburg, 2024

DECLARATION

I, Princess Moyo, declare that the work contained in this dissertation is my work, except to the extent indicated in the acknowledgement sections.

This dissertation is being submitted for a Master of Pharmacy degree at the University of the Witwatersrand, Johannesburg, South Africa.

This work has not been submitted for any other degree or examination at this university or any other university.



Signature

24 June 2024

Date

DEDICATION

I dedicate this study to my mother. Without your love and support, I would not have completed my MPharm degree. Thank you!

ACKNOWLEDGEMENTS

This study would not have been possible without certain people's unending support and assistance. I want to thank them for their personal and professional time and expertise.

To Prof. Neelaveni Padayachee, my supervisor, for always putting so much time and dedication into guiding my research and providing expertise to refine my work.

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ABSTRACT

Background: Influenza poses a great threat due to its prevalence, severity, and tendency for antigenic shifts that increase pandemic potential. This virus causes a respiratory illness that spreads quickly through droplets or contact with contaminated surfaces. Outbreaks are seasonal, and vaccination (ideally before the season begins) remains the most effective preventive measure, along with cough etiquette, handwashing, and avoiding ill individuals. Globally, influenza causes millions of severe infections annually, and in South Africa, it places a significant burden on healthcare systems and individual households. Healthcare workers' (HCWs) risk is elevated, and their vaccination is recommended to protect vulnerable patients and maintain uninterrupted medical services. Pharmacy students are future pharmacists and custodians of medicines who will advise and assist various communities. Therefore, there is a need to assess influenza vaccine acceptability in this priority group since HCWs are widely involved in and are significant advocates for different vaccination initiatives, especially now that the world is still dealing with the residual effects of the coronavirus disease (COVID-19) pandemic.

Aim of study: To investigate the knowledge, attitudes and beliefs of pharmacy students at nine pharmacy schools in South Africa regarding the influenza vaccine.

Methods: A descriptive quantitative study was conducted among undergraduate Bachelor of Pharmacy (BPharm) students in universities across various provinces including Limpopo, KwaZulu-Natal, Western Cape, North-West, Gauteng and Eastern Cape in South Africa. While nine pharmacy schools were approached, only eight universities participated. The inclusion criteria was limited to those in the BPharm programme and 18 years old and above. Those that had participated in the pilot study as well as participants that had more than ten unanswered questions were excluded from the study. A participant information sheet with details on the purpose of the study was adapted from a WITS template to provide further information to those invited to participate in the study. A questionnaire was adapted from a similar survey to suit the needs of this study and used to collect data. The questionnaire was piloted prior to administration to a sample population for study data collection. To assess the pharmacy students' knowledge, affected by their year of study and Work Based Learning (WBL) experience, a nominal scale (correct and incorrect) was used. The participants had to decide which answer most applied to the specific question. A five-point Likert scale was used to examine students' attitudes and beliefs about influenza vaccination. This method had five

options: “strongly disagree, disagree, neutral, agree and strongly agree” to assess students’ agreement with the statements provided.
All analyses were performed using STATA version 14 (StataCorp, USA), and statistical significance was determined at a 5% level.

Results: A total of 278 pharmacy students participated in the study. There were 77 questionnaires excluded, resulting in a total of 201 participants. Just over sixty percent were between 18 and 21 (123, 61.2%) years of age, with most participants being female (150, 74.6%). The study identified good knowledge among all participants with a mean average score of 5.7 out of 7. Almost all of the participants (195, 97.0%) expressed that they believed the influenza vaccine to be safe. The participants showed a positive attitude towards influenza with a mean score of 16.2 out of 20. Among the 83 participants who reported to have medical aid, 46 (55.40%) had been vaccinated for influenza. Among those who had been vaccinated before (102, 50.70%), only 47 (46.10 %) indicated that they had received influenza vaccines regularly while growing up. Of the 99 participants that did not vaccinate, (44; 44.44%) indicated that they did not vaccinate due to the low priority assigned to influenza prevention and 29 (29.29%) believed that their natural immune system offers sufficient protection from the flu.

Conclusion: There is a disconnect between knowledge and action regarding influenza vaccination among pharmacy students. Despite above-average understanding of influenza and vaccines, vaccination rates remain low. This may affect their advocacy for vaccination amongst patients attended to during WBL. While factors like medical aid coverage play a role, the study suggests the potential for long-term benefits from childhood vaccination. Limited support for mandatory vaccination policies highlights a distinct perspective within pharmacy education. This underscores the need for multifaceted interventions that dispel misconceptions, emphasise the crucial role of pharmacists in promoting vaccination and foster discussions around policy considerations. Further research is needed to pinpoint barriers and design tailored strategies to increase vaccination uptake among pharmacy students for improved public health outcomes.

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LIST OF ABBREVIATIONS

CDC	Centre for Disease Control
HBM	Health Belief Model
HCP	Healthcare Personnel
HCWs	Healthcare workers
HPV	Human papillomavirus
HREC	Human Research Ethics Committee
HSS	Health Science Students
ILI	Influenza-like Illnesses
NdoH	National Department of Health
NMU	Nelson Mandela University
NWU	North-West University
REDCap	Research Electronic Data Capture
RT-PCR	Reverse Transcription-Polymerase Chain Reaction
RU	Rhodes University
SAGE	Strategic Advisory Group of Experts
SAPC	South African Pharmacy Council
SARI	Severe Acute Respiratory Illness
SMU	Sefako Makgatho Health Sciences University
TUT	Tshwane University of Technology
UK	United Kingdom
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UWC	University of the Western Cape
WBL	Work Based Learning
WHO	World Health Organisation
WITS	University of the Witwatersrand

CHAPTER 1: INTRODUCTION

In this introductory chapter, the rationale for the study is explained, and an overview of the dissertation is provided. The introductory chapter presents the background of the study, followed by the problem statement, the purpose of the study, the general aim and objectives, and the research question.

1.1 Study background

1.1.1 Breakdown on Influenza

Influenza viruses are single-stranded ribonucleic acid (RNA) viruses and part of the *Orthomyxoviridae* family. There are three types: A, B, and C. Influenza A is the most common and can cause serious illness. It is prone to antigenic shifts, making it more likely to cause pandemics (Barberis *et al.,* 2016).

The influenza (flu) virus causes a viral respiratory illness that affects the nose, throat and lungs in all age groups worldwide. Transmission of this virus occurs when someone coughs, sneezes, or talks and droplets are exposed to another individual. It is also possible to get flu from touching infected surfaces or objects and then touching your mouth, eyes or nose. Flu infections tend to rise during the winter season, and in South Africa, this happens in the first week of June; however, it could start as early as April or as late as July. Research consistently demonstrates the efficacy of non-pharmaceutical interventions, such as physical distancing, hand hygiene, and mask-wearing, in mitigating the incidence of influenza outbreaks (Saunders-Hastings *et al.*, 2017; Bhatt *et al.,* 2021). However, a range of studies have found the flu vaccine to be more effective in preventing influenza viral infection and its complications (Godoy *et al.*, 2018). Lansbury *et al.* (2017) reported a vaccine effectiveness of 80% for adjuvanted and 66% for unadjuvanted vaccines against laboratory-confirmed influenza illness, with higher effectiveness in children. While Yang *et al.* (2014) reported a 52% effectiveness against all circulating influenza viruses, particularly the A(H1N1)pdm09 strain.

As a rule, this vaccine is best administered before the start of the season, i.e., as early as March. Other precautions include cough etiquette, washing hands with soap and avoiding sick people (Jefferson *et al.,* 2011).

According to the World Health Organisation (WHO), there are one billion cases of influenza worldwide each year, with three to five million of those cases being severe (WHO, 2023). In South Africa, more than fifty-six thousand hospitalisations and eleven thousand deaths are reported each year due to influenza inflicting a significant financial strain on both the healthcare

system and individual households (Edoka *et al.,* 2021). Healthcare workers (HCWs) may be at greater occupational risk of contracting the flu than the public, which could lead to hospital outbreaks and increased absenteeism that disrupts medical services (Awaidy *et al.,* 2020). The Strategic Advisory Group of Experts (SAGE) on Immunization noted that there is evidence that the influenza virus is transmitted from HCWs to patients, especially those who are at higher risk of developing severe illness, including patients (such as children under one year, the elderly, and those with immunosuppressive diseases) who do not produce an adequate immunological response to the influenza vaccine (SAGE working group, 2012).

1.1.2 Influenza vaccination

Influenza vaccines originated in the early 20th century. The first vaccine, developed in the 1930s, primarily targeted seasonal flu strains. Over the years, advancements in virology and vaccine technology have led to the development of more effective and broadly protective influenza vaccines. The vaccines have evolved to address the constant changes in influenza viruses through regular updates to match circulating strains. Today, influenza vaccines play a crucial role in preventing and mitigating the impact of seasonal flu outbreaks worldwide.

Influenza vaccines stimulate the immune system to recognise and defend against influenza viruses (Lorenzo and Fenton, 2013). Vaccines can contain inactivated viruses, live attenuated viruses, or pieces of the virus (antigens) that trigger an immune response. Once the vaccine is administered, the immune system recognises the viral antigens as foreign invaders. Antigens are usually proteins found on the surface of the virus. The immune system responds by producing antibodies which are proteins designed to neutralise or destroy the influenza virus. Antibodies are particular and target the specific strains of influenza included in the vaccine (Lopez and Legge, 2010).

The immune system generates memory cells in addition to antibodies. These cells retain information about specific antigens, enabling the immune system to mount a faster and more effective response if the person is later exposed to the influenza virus. When a vaccinated person is exposed to the influenza virus, their immune system recognises the virus based on the memory cells and antibodies. This rapid response helps prevent or lessen the severity of the infection.

It is also important to note that influenza viruses can change over time through mutations, leading to different strains; this is why new influenza vaccines are developed and recommended

each year to match the prevalent strains anticipated for the upcoming flu season. The goal is to provide optimal protection against the most likely influenza viruses in circulation.

Although vaccination is frequently mentioned as one of the most efficient approaches to managing infectious illnesses, an increasing percentage of people believe that immunisation is risky and unnecessary (Dubé *et al.,* 2013). Parents delaying their child's vaccinations, teenagers (or their parents) opting out of the human papillomavirus (HPV) vaccine, pregnant women not getting the influenza or pertussis vaccine, the elderly rejecting the influenza or shingles vaccine, and even HCWs rejecting the influenza vaccine are examples of reluctant people (Paterson *et al.,* 2016). Others take their time, weighing the benefits and risks of vaccination, consulting family, friends, or community members, conducting research online, and seeking advice from their healthcare provider. Some people choose to get vaccinated immediately because they believe it to be the norm, while others wait, weighing the benefits and risks of vaccination (Paterson *et al.,* 2016).

The WHO included vaccine hesitancy as one of the ten leading threats to global health (WHO, 2019b), and hesitancy by HCWs may threaten international efforts to keep vaccine-preventable diseases at bay. The WHO SAGE on Immunization has mapped the many causes of vaccination reluctance, and the term vaccine hesitancy that follows was created:
"Vaccine hesitancy refers to a delay in acceptance or refusal of vaccination despite the availability of vaccination services. Vaccine hesitancy is complex and context-specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence" (WHO, 2014).

1.1.3 Healthcare workers and influenza

In a South African study, suggestion that HCWs should be vaccinated against influenza, as a matter of priority, is to maintain good healthcare services during an influenza epidemic and protect vulnerable patients (Sibanda *et al.,* 2023). Some HCWs have said that patients' vaccination decisions are also their own (Baron-Epel *et al.,* 2012). Although the HCWs in the United Kingdom (UK) who were not immunised saw vaccination as a personal decision, they acknowledged that influenza was a public health concern. They said they should suggest the vaccine without letting their preferences affect the guidance they offer to patients (Marcu *et al.,* 2015). However, several studies have demonstrated the significance of HCW vaccination recommendations in decision-making. According to research conducted in the UK, nurses who had received the flu vaccination were significantly more inclined to suggest it to their patients.

They also reported understanding the vaccine's benefits (Zhang, While and Norman, 2010). Similar findings from research conducted in Nigeria showed that nurses would prescribe immunisation if willing to receive it themselves (Makwe and Anorlu, 2011). Another study conducted in Canada discovered that previously immunised midwives were more inclined to believe in the influenza vaccine's security and effectiveness and advise their patients' immunisation (Lee *et al.,* 2005).

Community pharmacists tend to be the first point of access for many patients who would like to self-medicate at the onset of any symptoms they feel are leading to illness; this means that the opinion of pharmacists is highly valued in the community they serve. Indiana State University's *Introduction to Public Communication* textbook defines attitudes as "an individual's general predisposition toward something as being good or bad, right or wrong, or negative or positive" (Johnston *et al.,* 2017). It defines beliefs as "propositions or positions that an individual holds as true or false without positive knowledge or proof." Therefore, future pharmacists' knowledge, attitudes, and beliefs regarding influenza vaccination may influence their patient recommendations (Johnston *et al.,* 2017).

Pharmacy students are the future pharmacists who will serve various communities, and there is a need to assess influenza vaccine acceptability in this priority group since HCWs are widely involved in and significant advocates for different vaccination initiatives, especially now that the world is dealing with the coronavirus disease (COVID-19) pandemic (Dini *et al.,* 2017). As the future of South Africa's healthcare system will be composed of pharmacy students, we will begin by evaluating their understanding of and acceptance of the influenza vaccination. The undergraduates will go on to play a crucial role in advising patients on how to stop the spread of diseases, viable therapies, and give immunisations.

1.2 Problem Statement

Pharmacy students face a high risk of influenza infection. Their close contact with those infected with influenza in relation to exposure to large groups of people in restricted areas at universities, hospitals, pharmacies, and public settings increases their exposure to the virus. While influenza can cause serious illness, data on its burden in Africa, including South Africa, remains limited (Murray *et al.,* 2015). This lack of data hinders effective policy development for influenza preparedness. Although similar studies have been undertaken among HCWs as a whole in South Africa (Sibanda *et al.,* 2023); Alobwede et al. (2022) and amongst healthcare students (Nukeri *et al.,* 2022), studies among pharmacy students specifically are lacking. This study aims to address this gap by investigating these factors in pharmacy students.

1.3 Significance of the research

Preventing the spread of influenza among pharmacy students is crucial, as they frequently interact with potentially infected individuals. Despite the importance of this issue, limited research explores this topic specifically within the African context. This study aims to expand the knowledge base on pharmacy students' knowledge, attitudes, and beliefs related to influenza. Findings may illuminate ways to improve existing protective measures, reduce absenteeism, and minimize associated costs. The information could also emphasize the importance of influenza prevention for pharmacy students.

South Africa's diverse socio-economic landscape influences individuals' risk of contracting influenza. Understanding the varying knowledge, attitudes, and beliefs around the virus could promote vaccination and other preventative measures like handwashing and avoiding crowded spaces.

1.4 Aim of the Study

This study aimed to investigate the knowledge, attitudes, and beliefs of pharmacy students at nine pharmacy schools in South Africa regarding the influenza vaccine.

1.5 Research Objectives

The objectives of the study were to:

- To determine the knowledge of the influenza virus and influenza vaccine among the first, second, third- and fourth-year pharmacy students.
- To determine the attitudes of first, second, third, and fourth-year pharmacy students toward influenza vaccination.
- To determine the beliefs of first, second, third, and fourth-year pharmacy students regarding influenza virus and vaccines.
- To identify and analyse relevant correlations in the data collected from first, second, third, and fourth-year pharmacy students.

1.6 Research Questions

- What do pharmacy students know about the influenza virus and the influenza vaccine?
- What are the attitudes and beliefs of pharmacy students towards influenza vaccination?
- Do pharmacy students' knowledge, attitudes, and beliefs differ depending on gender, age, ethnicity, and education level (Bachelor of Pharmacy years 1, 2, 3 & 4)?

CHAPTER 2: LITERATURE REVIEW

This chapter reviews the current literature on influenza and influenza vaccination, with an emphasis on healthcare personnel and students in health science programs.

2.1 Introduction

Influenza (flu), a highly contagious viral disease affecting both the upper and lower respiratory passages (Bokter and Hafner, 2022), represents a significant global public health concern with the potential for severe illness and mortality (Dangi and Jain, 2012; Javanian *et al.,* 2021). Primarily caused by Influenza virus types A, B, and C, the disease can manifest as localised outbreaks, seasonal epidemics, or widespread pandemics (Paules and Subbarao, 2017). Due to its prevalence in humans and capacity for rapid spread, Influenza A poses the most severe threat (Dangi and Jain, 2012). The virus's high mutability facilitates antigenic shifts and drifts, leading to potential pandemic strains (Dangi and Jain, 2012).

Vaccination remains the most effective preventative against influenza, with antiviral drugs available for treatment and prophylaxis (Javanian *et al.,* 2021). Understanding the foundational characteristics of influenza viruses is essential for healthcare professionals involved in the disease's management and prevention (Pratt, 2009). Vaccines expose the body to harmless viral components, stimulating an immune response and building protection against future infections (Pollard and Bijker, 2020). The influenza virus's ability to rapidly mutate necessitates regular vaccine updates to ensure optimal protection against circulating strains.

2.1.1 Pathology of the Influenza Virus

Influenza viruses, classified within the *Orthomyxoviridae* family, are single-stranded RNA viruses with three distinct types: A, B, and C. Influenza A poses the most significant threat due to its prevalence, potential for serious illness, and predisposition to antigenic shifts that increase its pandemic potential (Barberis *et al.,* 2016).

Influenza infections often lead to respiratory complications, with severe pneumonia being a frequent outcome (Taubenberger and Morens, 2008; Kuiken and Taubenberger, 2008). The virus demonstrates an affinity for tracheal and bronchial epithelial cells but can extend to the alveoli, contributing to severe pneumonia (Kuiken and Taubenberger, 2008). Extra-respiratory complications may occur, including encephalopathy, myocarditis, and myopathy (Kuiken and Taubenberger, 2008).

Specific to swine influenza (a subtype of influenza A), characteristic pathological findings include exudative bronchitis, bronchial epithelium damage, and pulmonary atelectasis (Shope, 1931). A comprehensive understanding of influenza virus pathology is essential for developing effective antiviral strategies, including vaccines and targeted therapeutic interventions.

2.1.2 Incubation period

The influenza virus typically incubates for one to four days, with an average of two days. Symptoms generally manifest 1-4 days after exposure. Infected individuals can transmit the virus even during the asymptomatic incubation period. Individual variations in incubation time exist, influenced by the specific viral strain (Nypaver, Dehlinger and Carter, 2021). For example, the incubation period of influenza B has been estimated at seven days (Ôwada, Sakamoto, and Tanaka, 1971). Research into avian influenza A(H7N9) suggests an incubation period of four days, with a 95th percentile of 6.5 days (Virlogeux *et al.,* 2015; Zhou, Li, and Uyeki, 2019). In the case of influenza A (H1N1-2009), the median incubation period was estimated at 1.43 to 1.64 days (Nishiura and Inaba, 2011). These findings underscore the need for further research to fully understand the strain-specific variations in the influenza virus's incubation period.

2.1.3 Symptoms of influenza

Influenza symptoms manifest approximately two days after viral exposure (WHO, 2023). Typical signs and symptoms include malaise, rigours, fever, myalgia, sore throat, and nasal congestion or discharge (Truter, 2012). Significantly, these symptoms can overlap with other respiratory infections, such as the common cold, limiting their diagnostic value in hospitalised patients (Van Den Dool *et al.,* 2008).

Influenza infections can also lead to neurological complications, including headaches, meningismus, seizures, and severe conditions like encephalitis and Reye's syndrome (Davis, Koster, and Cawthon, 2014). Severe cases, particularly those involving the H1N1 strain, may present with difficulty breathing, cough, headache, fatigue, sore throat, vomiting, and diarrhoea (Ishak, 2011). A complex interplay of viral and host factors influences the development of these symptoms (Fukuyama and Kawaoka, 2011).

Several misconceptions surround influenza and the common cold. Fever is often misconstrued as a defining feature of influenza, leading to underestimation of the disease's severity and a lack of understanding about vaccination (Mayrhuber *et al.,* 2018). Similar misconceptions exist

among healthcare workers (Monto and Osterhaus, 2006). Additionally, the belief that antibiotics treat viral infections like influenza and the common cold is widespread, highlighting the need for targeted education (Larson *et al.,* 2008; Duncan, 2015). While both are viral respiratory infections, influenza is typically more severe and debilitating than the common cold (Roxas and Jurenka, 2007; Dochez, 1936). Evidence-based symptomatic treatment strategies remain relevant for both conditions (Schellack and Labuschagne, 2014).

2.1.4 Transmission and infection

The primary mode of influenza transmission is respiratory droplets generated when an infected person talks, coughs, or sneezes (Tièche, Piso, and Bassetti, 2011). If inhaled or deposited onto the mucous membranes of the nose, mouth, or eyes, these droplets can lead to infection. Additionally, touching contaminated surfaces and subsequently touching one's mucous membranes creates another route for transmission. Intra-household transmission is exceptionally high among younger individuals (Tsang *et al.,* 2016).

Influenza viruses exhibit cross-species transmission potential between humans and swine, with humans contributing to the genetic diversity of influenza within swine populations (Nelson *et al.,* 2012). Animal models demonstrate that airborne influenza transmission is possible, with strain-specific variations in transmission efficiency (Mubareka *et al.,* 2009). Wild birds play a critical role in the spread of highly pathogenic avian influenza, posing a threat to both poultry and human populations in South Africa (Abolnik *et al.,* 2018; Abolnik, 2010).

Crucially, influenza-infected individuals become contagious approximately one day before symptom onset and remain so for up to five to seven days after becoming ill. This asymptomatic yet infectious period contributes significantly to the virus's rapid spread within communities, workplaces, and public spaces.

2.1.5 History of Influenza

While the influenza virus has impacted humanity for centuries, it was only formally identified in the late 1930s. Major outbreaks and pandemics mark its history, each revealing insights into the virus's evolution and impact as seen in **Table 2.1**. The fundamental distinction between an epidemic and a pandemic centres on a disease outbreak's scale and geographic extent.

An epidemic signifies a surge in disease cases within a defined region or community, exceeding the expected baseline level. It may impact a localised area or an entire country. Key indicators of an epidemic include a rapid rise in the incidence of a specific disease and potentially

increased rates of illness and mortality within the affected community (Collin, Radiguès & World Health Organization H1N1 Vaccine Task Force, 2009).

A pandemic represents a global disease outbreak characterised by widespread geographic distribution, and an exceptionally high proportion of the world's population affected. Pandemics often arise from novel viral strains with limited pre-existing immunity in the population, leading to extensive illness and potential societal disruption. The inherent unpredictability of influenza pandemics, such as the 2009 H1N1 swine-origin pandemic, underscores the challenges of forecasting future outbreaks (Taubenberger and Morens, 2010).

Table 2.1 Pertinent influenza pandemics throughout history

Pandemic (year)	Description
The Russian Flu (1889-1894)	The Russian flu of 1889, historically attributed to Myxovirus influenzae, is now being re-evaluated as a potential earlier coronavirus pandemic due to its clinical similarities to COVID-19 (Brüssow and Brüssow,2021; Berche, 2022). This pandemic, which had a low case-fatality rate but caused an estimated one million deaths worldwide, was characterized by its high contagiousness and rapid global spread (Berche, 2022).
The Spanish Flu (1918-1919)	The 1918 influenza pandemic, caused by the H1N1 influenza A virus, is one of the deadliest in history. With an estimated one-third of the world's population infected and 21 million deaths globally (Barberis *et al.,* 2016), its severity was unprecedented. While sharing clinical similarities with influenza of other years, the 1918 pandemic exhibited a mortality rate of 2.5% in the United States and disproportionately affected adults aged 20 to 40 (Taubenberger and Morens, 2010)
The Asian Flu (1957-1958)	The emergence of the H2N2 Asian influenza virus marked a shift in the virus's antigenic profile. Its traceable geographic spread mirrored that of the 1889 Russian flu pandemic, a characteristic less apparent in other inter-pandemic influenza outbreaks. As the first pandemic was studied with modern virological methods, the 1957 Asian flu offered valuable insights into the disease's pathology and clinical presentation, aligning with those observed during the 1918 pandemic (Taubenberger and Morens, 2010).
The Hong Kong Flu (1968-1969)	The 1968-1969 pandemic, caused by an H3N2 virus with avian gene reassortment, exhibited a surprisingly lower mortality impact than previous pandemics. This relative mildness has been attributed to pre-existing immunity to the retained neuraminidase (NA) component from prior circulating strains (Taubenberger and Morens, 2010).

The Swine Flu (2009)	The 2009 pandemic virus, a descendant of the 1918 strain via the classical swine H1N1 lineage, underscored the enduring legacy of the Spanish flu. Its emergence suggests that we continue to exist within the pandemic era initiated in 1918 (Taubenberger and Morens, 2010).

Pandemics, driven by ever-evolving viral strains, pose a recurring public health challenge. Vaccines are regularly developed to address these variations. Ongoing scientific surveillance and research remain crucial in understanding influenza's mutational capacity and mitigating its impact on global populations.

2.2 Influenza in South Africa

Influenza poses a recurring public health challenge in South Africa, with a historical record of outbreaks caused by various strains (Westwood, De Villiers Smit, and Oberholzer, 1958; Mendelson, 2010). Despite this, limitations in surveillance capacity and public awareness of vaccination remain areas for improvement (Schoub, McAnerney, and Besselaar, 2002). Additionally, zoonotic transmission risks of influenza A on swine farms highlight the crucial need for surveillance and targeted education for swine workers (Zowalaty *et al.,* 2021).

The impact of influenza in South Africa has been substantial, with outbreaks caused by specific strains having widespread effects (Besselaar, Schoub, and Blackburn, 1999). Notably, the 1918 influenza pandemic had a significant, albeit short-term, demographic impact and more subtle long-term economic consequences in the country (De Kadt *et al.,* 2020).

Importantly, co-infections and comorbidities prevalent in the African context, such as dengue, sickle cell disease, and malnutrition, increase the severity of influenza (Cohen *et al.,* 2015). Furthermore, South African studies link influenza virus infection to heightened mortality risks among hospitalised patients with confirmed pulmonary tuberculosis (Walaza *et al.,* 2015).

2.3 Health seeking behaviour

An individual's health-seeking behaviour is shaped by a complex interplay of personal, psychological, sociocultural, and environmental factors (Gilliland *et al.,* 1999). Healthcare workers (HCWs), particularly doctors, often exhibit distinct patterns due to their greater access to medical facilities and professional knowledge. Research suggests that doctors and nurses may prioritise self-medication for sudden-onset symptoms, leveraging their understanding of

physiology, anatomy, and pharmacology (Bana *et al.,* 2017). This tendency highlights the influence of professional expertise on health-seeking choices.

Beyond a professional context, illness severity, perceived treatment benefits, service accessibility and quality, communication with providers, and healthcare costs significantly impact health-seeking decisions (Asampong, 2015). Studies in Nigeria indicate that civil servants with higher education and health insurance coverage are more likely to utilise formal healthcare sources (Latunji and Akinyemi, 2018).

University students demonstrate diverse health-seeking behaviours. Research has shown that they frequently seek preventative health information and may consult a physician or seek relief from health concerns (Kalankesh *et al.,* 2019). Factors like health literacy, perceived susceptibility, and alcohol consumption can significantly influence health information-seeking behaviours in this population (Yilma *et al.,* 2017). In some cases, students within health sciences may resort to self-treatment or delay seeking care (Ajaegbu and Ubochi, 2016), while medical students may engage in self-prescription, potentially influenced by their medical knowledge and unfamiliarity with available services (Sawalha *et al.,* 2017).

The South African context reveals unique influences on health-seeking behaviours. Studies highlight homeless individuals' challenges, social factors, and service quality (Wentzel and Voce, 2012). In rural settings, traditional medicine, cosmological beliefs, and religious views play a role (Iyalomhe and Iyalomhe, 2014). Stigma, poverty, and illness-specific factors can present barriers for newly diagnosed HIV-infected individuals, especially in rural areas (Krüger *et al.,* 2009). Adolescents in Soweto exhibit gender-specific patterns in their healthcare utilisation (Otwombe *et al.,* 2015).

2.4 Impact of Influenza

2.4.1 Population

The influenza virus has a far-reaching global impact, with an estimated 10% of the population infected annually (Javanian *et al.,* 2021). Its high capacity for rapid evolution necessitates frequent updates to influenza vaccines (Russell *et al.,* 2008). Influenza A, the most prevalent and severe type, exhibits widespread transmissibility across large geographic regions (Dangi and Jain, 2012). Moreover, the COVID-19 pandemic has further contributed to the global burden of influenza, with significant severe cases and deaths reported (Lampejo, 2022).

In South Africa, specific populations bare a disproportionate burden of influenza. Individuals with HIV are at significantly increased risk of severe influenza-associated respiratory infections

(Cohen *et al.,* 2013). This vulnerability is further highlighted by research identifying the following groups as potential targets for influenza immunisation: children aged 6-59 months, individuals aged 5-64 years with HIV and pulmonary tuberculosis, pregnant women, and those aged 65 years and older (Tempia *et al.,* 2020).

2.4.2 Healthcare workers

Healthcare personnel (HCPs), especially those with direct patient contact, face elevated exposure risks to the influenza virus (Rule *et al.,* 2018). This vulnerability is compounded by low influenza vaccination compliance among HCPs (Bellia *et al.,* 2013). While vaccination is intended to protect HCPs and reduce risks to high-risk groups like the elderly, its effectiveness in achieving the latter remains under debate (Thomas *et al.,* 2006).

Recent research findings add further complexity to understanding influenza risk among HCPs. Coleman *et al.* (2019) found comparable influenza infection risks between HCPs and non-healthcare working adults. Similarly, Marshall *et al.* (2011) suggest that frontline HCPs may not face significantly higher risks of contracting pandemic influenza than non-clinical staff. These studies highlight the multifaceted nature of influenza risk factors within healthcare settings.

Influenza outbreaks in healthcare environments have a severe impact, with substantial consequences for HCPs and inpatients alike, underscoring the importance of vaccination programs and timely outbreak management (Horcajada *et al.,* 2003; Maltezou and Drancourt, 2003). Cases of nosocomial influenza transmission, even among vaccinated patients with severe pulmonary conditions, further emphasise the virus's ability to circumvent existing protections (Berg *et al.,* 2003). The 2009 pandemic influenza A(H1N1) pandemic in a pediatric oncology ward, potentially transmitted by an HCP, highlights these ongoing risks (Chironna *et al.,* 2010).

2.4.3 Myths about influenza

Myths and misconceptions about influenza persist throughout history. While the potential for specific avian influenza strains to cause a pandemic is a valid concern, it is not yet a reality and requires ongoing surveillance (Hilleman, 2002; Louie, 2005; Hall, 2007). Understanding the complex interplay of the virus's pathogenesis, epidemiology, and evolution necessitates continuous research (Wikramaratna and Gupta, 2009). Swine influenza (SI) is a respiratory disease caused by influenza A virus subtypes endemic in pigs. While SI viruses primarily affect pigs, they can occasionally infect humans, and limited human-to-human transmission has been

documented (Gangurde *et al.*, 2011). Many may think that eating the meat of the animal of an infected animal may cause infection, however there is no risk of transmitting the virus when properly cooked (Gangurde *et al.*, 2011).

Table 2.2 Common myths about influenza

Myth	Key concept
Transmission	**A common misconception is that influenza transmission only occurs in symptomatic individuals. However, infected individuals can spread the virus before symptom onset, and some may remain asymptomatic throughout the infection while retaining transmission potential (Patrozou and Mermel, 2009).**
Vaccine misconception	It is a myth that influenza vaccines cause influenza. While vaccines offer essential protection against severe illness, their effectiveness can vary due to factors like age and the match between the vaccine and circulating strains (Hanania, Atmar, and Castro, 2006; Jefferson, 2013; Kim *et al.,* 2021). In rare cases, autoimmune adverse events may occur (Toplak and Avčin, 2009). Mild local reactions or fever are possible side effects (Zimmerman, Ruben, and Ahwesh, 1997).
Diet and Immunity	The relationship between diet and influenza susceptibility is complex. While the adage "feed a cold, starve a fever" has some basis, both calorie restriction and malnutrition increase vulnerability to the virus (Van Den Brink *et al.,* 2002; Smith *et al.,* 2007; Gardner *et al.,* 2011; Taylor *et al.,* 2013; Smith, 2015). A balanced diet is crucial for maintaining a robust immune response.
Antibiotics	Antibiotics are ineffective against viral infections like influenza. Their use in influenza treatment is primarily indicated for secondary bacterial infections like pneumonia. However, antiviral agents like neuraminidase inhibitors are essential in reducing influenza symptoms and complications (Long, Mossad, and Goldman, 2000). Antibiotic overuse in influenza cases highlights the need for improved diagnostic accuracy (Nitsch-Osuch *et al.,* 2016). Monitoring ongoing viral evolution and novel antiviral development remains crucial (Palomba *et al.,* 2021).

2.5 Treatment and Management of Influenza

2.5.1 Reverse Transcription-Polymerase Chain Reaction (RT-PCR) in influenza

RT-PCR plays a crucial role in the rapid detection and treatment management of influenza. Studies have demonstrated its efficacy in accurately detecting influenza A virus subtypes (Payungporn *et al.,* 2004; Behzadi, Ziyaeyan, and Alborzi, 2016), as well as typing and subtyping influenza isolates (Atmar and Baxter, 1996). Advances in reverse genetics systems using T7 RNA polymerase further bolster the potential for developing novel influenza treatments (De Wit *et al.,* 2007).

2.5.2 Vaccination and chemoprophylaxis

Vaccines remain the cornerstone of influenza prevention, defined by the CDC as “a preparation that stimulates the body's immune response against diseases" (CDC, 2019). Influenza vaccines come in two main types: inactivated and live attenuated. The inactivated vaccines, which have been in use for over 50 years, are standardized based on the presence of the viral major surface glycoprotein hemagglutinin and induce strain-specific antibody responses (Sridhar, Brokstad and Cox, 2015). They stimulate antibody production compared to the broader immune response of live attenuated vaccines. On the other hand, live attenuated vaccines provide a multifaceted immune response but lack a clear correlate of protection (Sridhar, Brokstad and Cox, 2015). Both types have a good safety profile, with some adverse events being more prevalent in children and others in adults (Trombetta, Gianchecchi and Montomoli, 2018). However, they have limitations, such as moderate efficacy in certain populations and lack of cross-reactivity (Chen *et al.,* 2021).

A range of influenza vaccines are currently in clinical trials, demonstrating the ongoing pursuit of more effective immunization strategies. Earlier research offers promising insights into various approaches. Pyrhönen, Suni and Romo (1981) demonstrated the efficacy of a subunit influenza vaccine in reducing influenza A and B infections. Bernstein *et al.,* (2019) explored the potential of chimeric hemagglutinin-based universal influenza virus vaccines, successfully inducing broadly cross-reactive antibodies. Smith *et al.,* (2010) conducted phase 1 trials of adjuvanted plasmid DNA vaccines encoding influenza A virus H5 hemagglutinin, indicating good tolerability and immune response induction. Finally, Monto *et al.,* (2009) provided a direct comparison between inactivated and live attenuated influenza vaccines, concluding that the inactivated vaccine offered greater protection against symptomatic influenza A.

Despite the ongoing challenge of antigenic drift necessitating annual vaccine updates, their role in reducing the global burden of influenza is significant (Agor and Özaltın, 2018; Schultz-Cherry and Jones, 2010; Kim *et al.,* 2021). While imperfect, influenza vaccines protect against circulating strains and reduce disease severity (Jefferson, 2013; Tisa *et al.,* 2016).

2.5.2.1 Standard-dose trivalent vaccine

Single-dose trivalent influenza vaccines have proven efficacy in various populations (Talbot *et al.,* 2008; Treanor *et al.,* 2002; Gruber *et al.,* 1990; Tamura *et al.,* 1992). These studies demonstrate their immunogenicity, tolerability, and protective potential across age groups, including potential for cross-strain protection.

2.5.2.2 Quadrivalent vaccine

The development of quadrivalent influenza vaccines represents a significant advancement in influenza B prevention. Approved vaccines like Sinovac Biotech's Quadrivalent Influenza Vaccine and Sanofi Pasteur's VaxigripTetra™ exhibit high immunogenicity, broad protection against influenza B viruses, and a favourable safety profile (Traynor, 2012; Tao *et al.,* 2021; Gresset-Bourgeois *et al.,* 2017). Innovations like Fluzone Intradermal Quadrivalent improve vaccine delivery and accessibility (Robertson *et al.,* 2016).

2.5.3 Neuraminidase inhibitors and antiviral drugs

Neuraminidase inhibitors offer both treatment and prophylaxis options against influenza, potentially reducing the severity, duration, hospitalisations, and mortality (Varghese, 1999; Kim, Chen, and Mendel, 1999; Bassetti, Castaldo, and Carnelutti, 2019). However, considerations like the emergence of drug-resistant strains and the potential for treatment failures in severe cases highlight the need for ongoing research and combination therapies (Dunning *et al.,* 2014). Rationally designed neuraminidase inhibitors remain safe and effective when used appropriately (Roberts, 2001; Wutzler and Vogel, 2000).

2.5.4 Vaccination of healthcare workers

Vaccinating healthcare workers (HCWs) is a critical strategy to reduce influenza transmission and protect high-risk patients (Jędrzejek and Mastalerz-Migas, 2021). Strong evidence links HCW vaccination with reduced patient mortality, health service utilisation, and hospital admissions (Davies and Hampson, 2007). Educational initiatives and improved accessibility are vital for addressing HCW hesitancy stemming from side effect concerns and misconceptions (Naz, Çevik, and Aykın, 2009). Research indicates significant benefits associated with HCW influenza vaccination, though there is some debate regarding its effectiveness in protecting patients when they are unvaccinated (Nishi, Mizuguchi, and Ueda, 2001; Thomas *et al.,* 2006).

2.5.5 WHO and CDC Influenza Recommendations

The WHO recommends early antiviral treatment for high-risk groups suspected of having influenza A(H1N1)pdm09 virus (swine flu), such as pregnant women, young children, and individuals with underlying health conditions (Zarocostas, 2009). While the CDC focuses on influenza vaccination, recommending two doses for children aged six months to eight years old. They also advise vaccination for high-risk groups similar to those identified by WHO, including young children, adults with underlying medical conditions, and healthcare workers (Fiore *et al.,* 2009).

Both organizations advocate for antiviral medications like oseltamivir and zanamivir for treating and preventing influenza infections (Fiore *et al.,* 2009; Schünemann *et al.,* 2007).

2.6 Conceptual Framework

This study uses the Health Belief Model (HBM), a widely recognised conceptual framework for understanding health behaviour change at the individual level (Green and Murphy, 2014). It was created by social psychologists at the U.S. Public Health Service to investigate why individuals weren't engaging in disease prevention and detection programs (Ban and Kim, 2020). Initial research on the HBM was released in the 1950s and early 1960s through various articles and reports, with one of the earliest publications being Godfrey M. Hochbaum's "Public Participation in Medical Screening Programs: A Socio-Psychological Study" in 1958.

It posits that individuals mentally assess the benefits and costs of behaviour change, influenced by factors such as perceived susceptibility, severity, benefits, and barriers (Tufănaru, Mocean, and Haţieganu, 2009). Self-efficacy, the belief in one's ability to take action, is also a key component (Green and Murphy, 2014). The model has been applied to various health-related behaviours, including HIV risk behaviour change (Rosenstock, Strecher, and Becker, 1994) and serves as a guide for understanding and promoting positive health behaviours (Gözüm and Çapık, 2014).

The model's constructs, including perceived susceptibility, severity, benefits, and barriers, have been validated and can be measured with convergent validity (Cummings, 1978) **(Figure 2.1)**. The model's constructs can mediate relationships in complex ways, such as through moderated and serial mediation (Bond, Aiken, and Somerville, 1992). Internal cues, such as an individual's general health values and beliefs about vulnerability and consequences, also play a role in this assessment (Tufănaru, Mocean, and Haţieganu, 2009). For example, in adolescents with insulin-dependent diabetes, the HBM's Benefits and Cues constructs were related to compliance (Bond, Aiken, and Somerville, 1992). However, the model has been criticised for its lack of correspondence between an individual's beliefs and health-related behaviour (Pedro and Roales-Nieto, 2003).

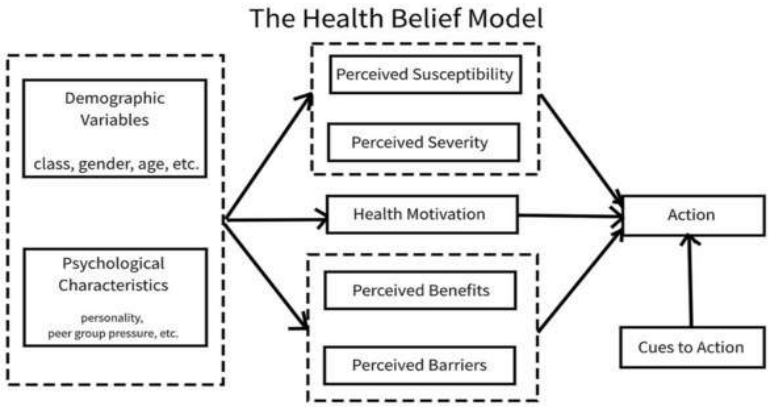


Figure 2.1 Health Belief Model

2.7 Global Surveillance Network

The Global Influenza Hospital Surveillance Network (GIHSN) is a new platform focusing on severe influenza, complementing the existing global surveillance efforts (Puig-Barberà *et al.,* 2015). The World Health Organization (WHO) Global Influenza Surveillance Network, established in 1952, plays a central role in global public health by providing detailed information on circulating seasonal influenza viruses and responding to pandemics and other threats (Ziegler, Mamahit, and Cox, 2018). This network is critical to the WHO's Global Influenza Programme, including the WHO Influenza Surveillance Network (Taniguchi, 2006). The US military also has a global laboratory-based network for influenza and respiratory disease surveillance (Sueker *et al.,* 2010). These networks collectively contribute to the worldwide effort to monitor and respond to influenza outbreaks.

In South Africa, influenza surveillance has been a focus of research, with the National Institute for Virology playing a pivotal role in characterising influenza isolates (Schoub, McAnerney, and Besselaar, 2002). The country has two surveillance systems, one for influenza-like illness (ILI) and another for severe acute respiratory infection (SARI), with the former being more nationally representative and financially sustainable (Budgell *et al.,* 2015). The importance of strengthening influenza surveillance in Africa, including South Africa, has been emphasised, particularly in understanding the seasonality of the virus (McAnerney *et al.,* 2012). The need for targeted prevention policies and the detection of novel influenza viruses has also been highlighted (Radin *et al.,* 2012).

CHAPTER 3: METHODOLOGY

This chapter describes the study sites, research design, study population, sample size determination, sampling techniques, data collection methods, data quality control, data analysis and ethical considerations.

3.1 Study site

The study took place in various provinces across South Africa including Limpopo, KwaZulu-Natal, North-West, Western Cape, Gauteng (Johannesburg and Pretoria) and Eastern Cape (Gqweberha and Makhanda) at eight universities with pharmacy schools; the University of Limpopo (UL), the University of KwaZulu-Natal (UKZN), North-West University (NWU), the University of the Western Cape (UWC), the University of the Witwatersrand (WITS), Sefako Makgatho Health Sciences University (SMU), Nelson Mandela University (NMU) and Rhodes University (RU).

Tshwane University of Technology (TUT) was invited to participate in the study, and the university registrar and head of the School of Pharmaceutical Sciences granted approval. However, due to time constraints TUT was then excluded from the study.

These universities are accredited by the South African Pharmacy Council (SAPC) to provide higher education and training qualifications in pharmacy, thereby making them a suitable setting for this study.

3.2 Research design

A descriptive quantitative cross-sectional survey was undertaken among undergraduate students in all years (1st to 4th year) of the Bachelor of Pharmacy programme. Pharmacists are well-positioned to discuss and counsel patients or individuals on vaccines as they tend to be first point contact, more accessible without appointment in comparison to other healthcare providers (Cassidy *et al.,* 2021). Participants were recruited from WITS, UKZN, NWU, UL, NMU, UWC, RU and SMU. A participant information sheet (**Appendix I**) was adapted from a WITS template to provide further information to those invited to participate in the study. This information sheet provided details on the purpose and aim of the study. A questionnaire (**Appendix II**) used to collect data. It was adapted from a similar survey on university students' knowledge, attitudes and beliefs about the influenza vaccine (Ryan *et al.,* 2019) to suit the needs of this study. Due to this adaptation, the questionnaire was piloted prior to administration to a sample population for study data collection.

3.3 Study population

The study strictly called for participants who were undergraduate students of the Bachelor of Pharmacy degree at any level of study. The data was collected from May 2023 till the end of August 2023.

3.3.1 Inclusion criteria

- Willing to participate in the survey and enrol in a Bachelor of Pharmacy academic programme (all years of study)
- 18 years old and above

3.3.2 Exclusion criteria

Participant questionnaires with more than ten unanswered questions were excluded from the data analysis. Students who participated in the pilot study were also excluded from the study. If any student withdrew from the study after the commencement of the survey, they were permitted to do so, and the incomplete survey was excluded from the data analysis.

3.4 Sample size estimation

According to the SAPC's website, there were a total of 3969 pharmacy students (**Table 3.1**) in the aforementioned universities. Using the online Raosoft sample size calculator, a sample size of 351 students was calculated.

The sample size was recalculated to exclude TUT; this yielded a minimum recommended size of 349 participants. For the eight universities included in the study, based on a population size of 3729, a margin of error of 5% and a confidence level of 95%:

$$N = \frac{z^2 p(1-p)}{d^2}$$

Equation 1: Sample size calculation. N = Sample population size; z = statistical level of confidence (95%); p = Expected proportion of the sample with characteristics (p = 0.5); d = margin of error (d = 0.05).

Table 3.1 Number of pharmacy students per university

University	1st year	2nd year	3rd year	4th year	Total
NMU	98	105	154	138	495
NWU	633	174	28	17	852
RU	165	164	184	13	526
SMU	74	70	76	37	257
TUT	79	67	53	41	240
UKZN	103	109	98	133	443
UL	83	86	84	64	317
UWC	140	71	59	133	403
WITS	144	117	69	106	436
					3969

3.5 Sampling

A sample is a subset of a population used in research to represent the larger group. Sampling, as defined by Salaria (2012), involves selecting a smaller number of individuals for analysis to gain insights about the entire population. Survey samples broadly fall into two categories: probability and non-probability (Lynn, Levy, & Lemeshow, 1993).

This study employed purposive (judgmental) sampling, a form of non-probability sampling. This technique allows researchers to handpick participants based on specific characteristics, in this case, their status as pharmacy students.

3.6 Data collection

3.6.1 Data collection instrument

This cross-sectional study utilized Research Electronic Data Capture (REDCap) tools hosted at WITS for secure data collection and management. REDCap's features, such as its intuitive interface, audit trails, automated export to statistical packages, and data import capabilities, facilitated efficient research processes (Ryan *et al.,* 2019).

The questionnaire, designed to assess the 5C antecedents of vaccination (Betsch *et al.,* 2020), includes both open- (limited to those that select ‘other’ as a response) and closed-ended questions. These questions explored participants' demographics, knowledge, attitudes, and beliefs about the influenza vaccine.

The questionnaire (**Appendix II**) used a nominal scale (correct and incorrect) to assess pharmacy students' knowledge. The participants had to decide which answer most applied to

the specific question. This would be affected by their year of study and Work Based Learning (WBL) experience.

A five-point Likert scale was used to examine students' attitudes and beliefs about influenza vaccination. This method had five options: “strongly disagree, disagree, neutral, agree and strongly agree” to assess students’ agreement with the statements provided.

The questionnaire consisted of five sections.

- Part 1 - Demographic information that classifies participants for comparative analysis;
- Part 2 - Influenza vaccination history;
- Part 3 – Determining the knowledge of the influenza virus and influenza vaccines;
- Part 4 – Exploring the attitudes towards influenza vaccination;
- Part 5 – Examining the beliefs surrounding their choices on influenza vaccination.

The last two questions were multiple choice questions, where the participant selected various answers or explain their answer under the ‘other’ section. These open-ended questions focused on reasons for vaccine refusal, willingness to receive it, and confidence in recommending it to their current/future patients.

Department heads (HoDs) of pharmacy practice nationally at the nine pharmacy departments were contacted via email to request participation. The email included a permission request document adapted for each university (**Appendix III**). Upon agreement, the HoDs were provided with the link to the survey on the REDCap system. Reminder emails were sent to the HoDs to increase the response rate. The first email was sent at the three-week mark, and the second at the five-week mark.

3.6.2 Validity and reliability of the instrument

The questionnaire was piloted for validity as a survey tool. A methodology’s validity concerns what an instrument measures and how well it does so (Ahmed and Ishtiaq, 2021). Instrument validation increases instrument reliability by lowering measurement errors, which can be achieved in several ways. Noble & Smith (2015) define reliability as "consistency within the analytical procedures," and reliability quantifies the degree to which an instrument consistently produces the same results under the same conditions.

3.6.3 Pilot study

To ensure the questionnaire's clarity and relevance, it underwent both content validation and a pilot study. Content validity assesses whether the questions accurately represent the concepts being measured (Aday and Cornelius, 2006).

The pilot study involved 47 pharmacy students (10% of the student population), across all years of study. This ensured a representative sample and evaluated the questionnaire's grammar, design, understandability, and practicality. Participants provided feedback on:

- Completion time
- Suggestions for improvement
- Difficulty understanding questions.

Based on the feedback, the survey was refined. For instance, the term "contraindicated" was clarified with the phrase "not meant to be used" to increase comprehension. The estimated completion time (under ten minutes) was also included in the invitation email.

3.7 Data Analysis and data storage

The results from the survey were stored on REDCap and were password protected. Only the researcher and the supervisor had access to the password, thereby maintaining confidentiality and security of data.

All questionnaires were assessed for errors. For the knowledge section, seven questions required a Correct or Incorrect response. “Incorrect” was scored 0, and “Correct” was scored 1. A Likert scale (strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5)) was used for the attitudes, perceptions and practice sections. The total score, each for knowledge, attitudes, and beliefs, was generated as a sum of the responses with a total score of 7 representing the highest knowledge, a score of 20 (4 questions x 5) for attitudes representing the most positive attitude, and a score of 30 (6 questions x 5) representing the most positive beliefs. Overall knowledge responses were determined as poor knowledge (score < 3.5) or good knowledge (score >3.5). Overall attitude responses were defined as either unfavourable (score <10) or positive (score >10). Overall practice response was determined as either poor (score <15) or good (score >15). Furthermore, ordinal recoding was performed, combining “strongly disagree” and “disagree” into one category (disagree), “agree” and “strongly agree” into another category (agree) and relabelling “neutral”, effectively transforming the 5-point Likert scale into a 3-point Likert scale (Chakrabartty, 2023). Descriptive statistics (frequencies and percentages) were used for demographic data such as age and gender and critical outcomes for all variables. The statistical programme StataSE 17 was used for in-depth analysis. Chi-square testing was

used to compare group differences in knowledge about influenza vaccination, with a fixed significance threshold of $\alpha = 0.05$ and a confidence interval of 95. Categorical variables were summarised using frequencies and proportions. Quantitative variables were presented using medians and interquartile ranges. Statistical significance was defined at a p-value < 0.05. Binary logistic regression was applied to identify factors affecting knowledge. Season. The Pearson chi-square test assessed the statistical association between the outcome and categorical predictor variables.

3.8 Ethical Considerations

The WITS Human Research Ethics Committee (HREC) (Medical) and the other seven universities included in the study granted ethical clearance (**Appendix IV**). A page displayed the participant information sheet before the commencement of the online survey and requested the participant to indicate whether they consented to participate in the study. Completion of the questionnaire was voluntary, and responses were anonymous. All surveys were confidential, and no participant asked for personal information. This study was for academic purposes only - to fulfil my Master of Pharmacy degree.

CHAPTER 4: RESULTS

This chapter presents the results of the statistical analysis, addressing the study's four key objectives: assessing pharmacy students' knowledge of the influenza virus and vaccine across all years of study, examining their attitudes towards influenza vaccination, investigating their beliefs about the influenza virus and vaccine, and analysing relationships between demographic variables, attitudes, and intention to receive the influenza vaccination.

The chapter begins by outlining the socio-demographic characteristics of participants, including age, gender, ethnicity, enrolment status, year of study, living arrangements, and previous qualifications. Finally, the chapter explores variations in attitudes, perceptions, and behaviours based on demographics like gender, age, ethnicity, and year of study.

4.1 Demographic characteristics of the participants

A total of 278 responses were received on REDCap; this makes the response rate 76.7%, as the minimum sample size was calculated to be 349 participants. Of those who responded, 77 were excluded as the participants had left more than ten questions unanswered; thus, a total of 201 participants were included in the study. Most of the participants were between 18 and 21 (123, 61.2%) years of age, with one participant reporting their gender as ‘other’ while most participants reported being females (150, 74.6%), which outnumbered the males (50, 24.9%), as shown in Table 4.1. More than two-thirds (157, 78.1%) of the participants were black. Given that the study was undertaken in South African universities, most participants were South African (193, 96.0%). Table 4.1 also shows that the majority of the participants were in their fourth year of study (68, 33.8%), lived off campus (120, 59.7%) and had no other tertiary qualification (185, 92.0%).

Table 4.1 Socio-demographic characteristics of the survey participants

Variable	Frequency (n=201)	Percentage (%)
Age group		
18-21	123	61.2
22-25	60	29.8
25+	18	9.0
Gender		
Male	50	24.9
Female	150	74.6
Other	1	0.5
Ethnicity		
Black	157	78.1
White	20	10
Other	24	11.9
Student Enrolment		
Domestic	193	96.0
International	8	4
Year of Study		
1st	56	27.9
2nd	39	19.4
3rd	38	18.9
4th	68	33.8
Living Arrangement		
Off-Campus	120	59.7
On Campus	81	40.3
Other tertiary qualifications		
Yes	16	8.0
No	185	92.0

The average scores out of seven between years of study were similar, as shown in **Figure 4.1**. The 2nd years were most knowledgeable with a mean score of 5.79 out of 7 (82.8%) while the 3rd years were the least knowledgeable with a mean score of 5.69 out of 7 (79.7%).

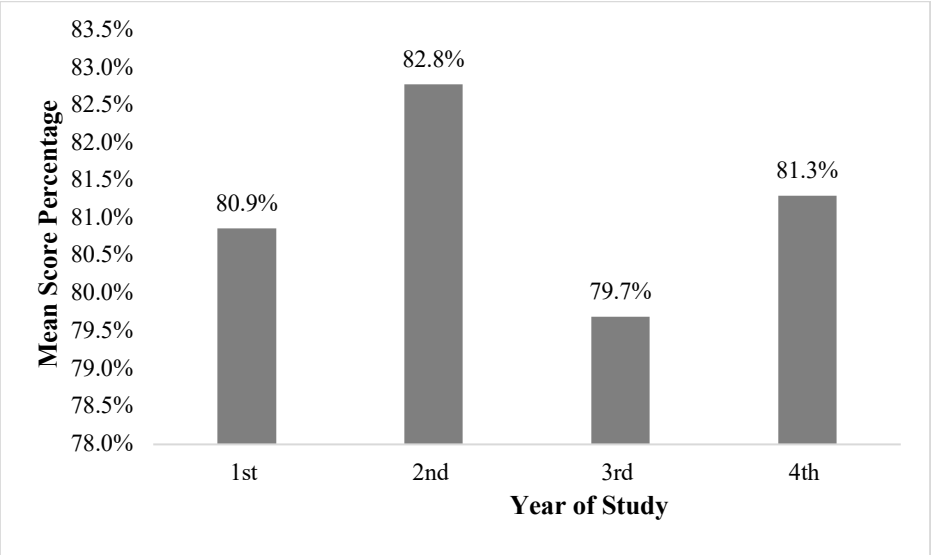


Figure 4.1 Mean scores in terms of the distribution of study participants' year of study and their level of knowledge on influenza vaccinations.

4.2 Descriptive information on the participants' influenza vaccination history

In **Table 4.2,** it is shown that over half of the participants (131, 65.2%) answered 'yes' to the question 'Have you ever had the influenza virus?' but slightly less than half (99, 49.3%) reported that they had never been vaccinated for flu. Of those who reported to have medical aid, 46 (55.4%) had been vaccinated for influenza. Among those who had been vaccinated before (102, 50.7%), only 47 (46.1 %) indicated that they had received influenza vaccines regularly while growing up. Regarding the influence of receiving the influenza vaccination within their lifetime, the majority (123, 61.19%) said that having received (or not received) an influenza vaccine did not influence their vaccination decision now.

Table 4.2 Participants' vaccination history

	Total (n = 201)	Percentage (%)
Q1 Do you have medical aid?		
No	118	58.7
Yes	83	41.3
Q2 Have you ever had the influenza virus?		
No	70	34.8
Yes	131	65.2
Q3 Have you ever been vaccinated for influenza?		
Yes	102	50.7
No	99	49.3
Q4 Did you receive influenza vaccines growing up?		
No	140	69.7
Yes	61	30.3
Q5 Has your experience of receiving (or not receiving) influenza vaccines growing up influenced your decision to get a vaccine now?		
No	123	61.2
Yes	78	38.8
Q6 Do you intend to get an influenza vaccine next flu season?		
No	90	44.8
Yes	111	55.2

4.3 Descriptive information on the participants' knowledge of the influenza virus and vaccine

Overall, the student population was knowledgeable about the influenza virus and vaccine. The results indicate that most participants (195, 97.0%) considered the influenza vaccine safe (**Table 4.3)**. Of those who indicated that the vaccine is safe, only 102 (52.3%) had ever been vaccinated, but this made up 100% of those who had been vaccinated.

Slightly less than half (99, 49.3%) of the participants indicated that there is a risk of getting the flu from the influenza vaccine. Most participants (119, 59.2%) reported that the flu vaccine is contraindicated in those with egg allergies.

Table 4.3 Assessing the knowledge of the influenza virus and vaccine amongst pharmacy students

Variable	Vaccinated (n=102)		Not Vaccinated (n=99)		Total (n=201)		p-value
	N	%	N	%	N	%	
Q1 Influenza is a highly contagious virus							0.161
Correct	96	94.1	97	98	193	96	
Incorrect	6	5.9	2	2	8	4	
Q2 The influenza vaccine is safe							0.012*
Correct	102	100	93	93.9	195	97	
Incorrect	0	0	6	6.1	6	3	
Q3 The influenza vaccine is effective in the prevention of influenza							0.323
Correct	87	85.3	89	89.9	176	87.6	
Incorrect	15	14.7	10	10.1	25	12.4	
Q4 Influenza vaccination reduces the risk of patients becoming seriously ill from influenza and its complications							0.080
Correct	100	98	92	92.9	192	95.5	
Incorrect	2	2	7	7.1	9	4.5	
Q5 There is a risk of getting 'the flu' from the influenza vaccine							0.619
Correct	52	51	47	47.5	99	49.3	
Incorrect	50	49	52	52.5	102	50.7	
Q6 Serious adverse events from the influenza vaccine are very rare							0.776
Correct	86	84.3	82	82.8	168	83.6	
Incorrect	16	15.7	17	17.2	33	16.4	
Q7 The influenza vaccine is contraindicated (not supposed to be used) in people with egg allergies							0.861
Correct	41	40.2	41	41.4	82	40.8	
Incorrect	61	59.8	58	58.6	119	59.2	

*p< 0.05

Overall, as shown in **Table 4.4** below, the mean knowledge score for the entire study was 5.7 (1.35), the mean attitudes score was 16.2 (0.376), and the mean beliefs score was 20.7(±0.596).

Table 4.4 Mean scores for knowledge, attitudes and beliefs of pharmacy students. Data presented as mean (±SD)

Variable	Maximum Score Possible	Achieved Score
Knowledge	7	5.7 (±1.35)
Attitudes	20	16.2 (±0.376)
Beliefs	30	20.7(±0.596)

To identify the factors associated with the seven items (Table 4.3), binary logistic regression was applied, using Q1-7 as dependent factors and the participants' Year of study and Other qualifications as covariates, as shown in **Table 4.5**.

Table 4.5 Factors affecting students' knowledge about influenza vaccination

Variables	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Year of study (ref: 1st year) **Crude OR** **[CI 95%]**							
2nd year	0.68 [0.13 - 3.56]	1	3.08 [0.62 - 15.39]	2.15 [0.22 - 21.48]	1.49 [0.66 - 3.40]	0.55 [0.21 - 1.47]	0.97 [0.41 - 2.31]
3rd year	2.09 [0.21 - 20.93]	0.67 [0.09 - 4.95]	0.74 [0.24 - 2.24]	0.66 [0.13 - 3.46]	0.93 [0.41 - 2.14]	2.53 [0.65 - 9.91]	1.5 [0.68 - 3.67]
4th year	3.79 [0.38 - 37.51]	1.22 [0.17 - 8.97]	1.25 [0.44 -3.58]	1.87 [0.30 - 11.59]	1.15 [0.57 - 2.34]	1.43 [0.54 - 3.80]	1.84 [0.89 - 3.81]
Other qualifications (ref: No) **Crude OR** **[CI 95%]**							
Yes	0.59 [0.07 - 5.12]	1	0.99 [0.21 - 4.66]	1	1.03 [0.37 - 2.87]	0.84 [0.23 - 3.12]	1.14 [0.41 - 3.20]

4.4 Participants' attitudes and beliefs towards the influenza virus and vaccine

The findings of this study indicate that most participants found the influenza vaccine acceptable, as shown in **Table 4.6**. The participants showed an overall positive attitude towards the influenza vaccine. Many participants (130, 64.7%) disagreed (including those who strongly disagreed) that the influenza vaccine is only minimally effective. A large majority (142, 74.1%) of participants agreed (including those who strongly agreed) that there is a risk of transmitting influenza to patients during their pharmacy hours.

The only statistically significant question was whether the participants thought that influenza vaccines were not crucial for HCWs. More than three-quarters of the participants disagreed (including those who strongly disagreed): 176 (87.6%). This showed a positive attitude towards influenza vaccination.

Table 4.6 Assessing the attitudes of the participants towards the influenza virus and vaccine

Variable	Vaccinated (n=102)		Not Vaccinated (n=99)		Total (n=201)		P-value
Attitudes	**N**	**%**	**N**	**%**	**N**	**%**	
Q1 There are populations such as infants and the immuno-compromised who cannot receive an influenza vaccination, and by receiving a vaccination myself, I am helping limit transmission throughout my community							0.494
Agree	36	35.3	31	31.3	67	33.3	
Disagree	1	1	5	5.1	6	3	
Neutral	13	12.7	13	13.1	26	12.9	
Strongly agree	46	45.1	46	46.5	92	45.8	
Strongly disagree	6	5.9	4	4	10	5	
Q2 The influenza vaccine is only minimally effective and thus not necessary if you are young and healthy							0.145
Agree	13	12.7	13	13.1	26	12.9	
Disagree	38	37.3	42	42.4	80	39.8	
Neutral	22	21.6	18	18.2	40	19.9	
Strongly agree	0	0	5	5.1	5	2.5	
Strongly disagree	29	28.4	21	21.2	50	24.9	
Q3 Vaccines are not crucial for healthcare workers							0.049*
Agree	3	2.9	4	4	7	3.5	
Disagree	17	16.7	14	14.1	31	15.4	
Neutral	2	2	10	10.1	12	6	
Strongly agree	1	1	5	5.1	6	3	
Strongly disagree	79	77.5	66	66.7	145	72.1	
Q4 When I am completing my pharmacy hours, I am at risk of transmitting influenza to patients							0.607
Agree	43	42.2	42	42.4	85	42.3	
Disagree	6	5.9	5	5.1	11	5.5	
Neutral	16	15.7	14	14.1	30	14.9	
Strongly agree	34	33.3	30	30.3	64	31.8	
Strongly disagree	3	2.9	8	8.1	11	5.5	

*$P < 0.05$

There is a diversity of opinions regarding whether influenza vaccination should be compulsory for pharmacy students, with responses spread across agree (59, 29.3%), neutral (70, 34.8%), and disagree (72, 35.8%), as shown in **Table 4.7**. A notable portion of participants (46.27%) indicate that they would not have gotten the flu vaccine if they were not required to, suggesting that mandatory policies might play a role in vaccination uptake.

Table 4.7 Assessing the beliefs of the participants towards the influenza virus and vaccine

Variable	Vaccinated (n=102)		Not vaccinated (n=99)		Total (n=201)		P-value
Beliefs	**N**	**%**	**N**	**%**	**N**	**%**	
Q1 As a pharmacy student, annual influenza vaccination is essential to me							0.003*
Agree	37	36.3	29	29.3	66	32.8	
Disagree	5	4.9	15	15.2	20	10.0	
Neutral	25	24.5	22	22.2	47	23.4	
Strongly agree	35	34.3	25	25.3	60	29.9	
Strongly disagree	0	0	8	8.1	8	4.0	
Q2 Influenza vaccination should be compulsory for pharmacy students							0.571
Agree	14	13.7	14	14.1	28	13.9	
Disagree	19	18.6	20	20.2	39	19.4	
Neutral	34	33.3	36	36.4	70	34.8	
Strongly agree	20	19.6	11	11.1	31	15.4	
Strongly disagree	15	14.7	18	18.2	33	16.4	
Q3 It is the duty of a healthcare worker to prevent transmission of influenza to patients							0.996
Agree	40	39.2	36	36.4	76	37.8	
Disagree	6	5.9	6	6.1	12	6.0	
Neutral	13	12.7	13	13.1	26	12.9	
Strongly agree	40	39.2	41	41.4	81	40.3	
Strongly disagree	3	2.9	3	3	6	3.0	
Q4 I believe vaccination is the best way to protect myself and others							0.188
Agree	37	36.3	37	37.4	74	36.8	
Disagree	2	2	4	4	6	3.0	
Neutral	14	13.7	16	16.2	30	14.9	
Strongly agree	49	48	38	38.4	87	43.3	
Strongly disagree	0	0	4	4	4	2.0	
Q5 I was required to get a flu vaccine (for any reason)							0.049*
Agree	24	23.5	13	13.1	37	18.4	
Disagree	29	28.4	36	36.4	65	32.3	
Neutral	26	25.5	23	23.2	49	24.4	
Strongly agree	10	9.8	4	4	14	7.0	
Strongly disagree	13	12.7	23	23.2	36	17.9	
Q6 If I were NOT required to get the flu vaccine, I would NOT have gotten it							0.067
Agree	18	17.6	18	18.4	36	18.0	
Disagree	35	34.3	28	28.6	63	31.5	
Neutral	23	22.5	26	26.5	49	24.5	
Strongly agree	6	5.9	16	16.3	22	11.0	
Strongly disagree	20	19.6	10	10.2	30	15.0	

4.5 Factors reported by patients that cause vaccine refusal or vaccine uptake

Over half of the participants (102, 50.7%) indicated they had been vaccinated before. In **Figure 4.2,** the main reason (54, 52.9%) for vaccine uptake was reported as being taught about the flu vaccine, including how it works and its importance, suggesting that education and awareness campaigns may positively influence vaccination decisions. A substantial portion (47, 46.1%) of participants got the flu vaccine because it was recommended by a health professional, underlining the influence and trust placed in the advice of healthcare providers. The participants indicated that encouragement from parents or relatives (39, 38.2%) also affected their vaccine uptake. Some of the 'Other' reasons (6, 5.9%) listed by participants included wanting to protect themselves and others against the influenza virus and making vaccination compulsory as part of their registration as Bachelor of Pharmacy Undergraduates.

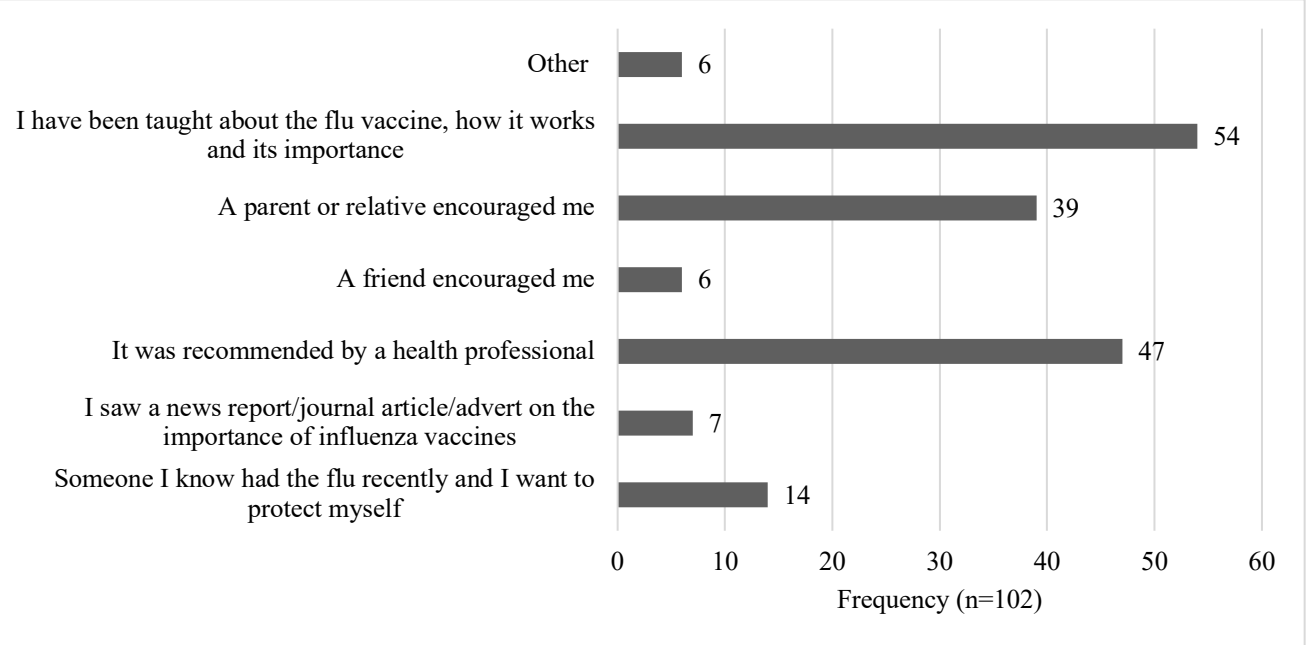


Figure 4.2 Reasons participants gave for being vaccinated

In **Figure 4.3,** a significant percentage (44; 44.44%) of participants stated that getting a flu vaccine has never been a priority for them, indicating a lack of perceived importance or urgency. Whilst a notable portion (29; 29.29%) believes that their natural immune system offers sufficient protection from the flu, 26 (26.26%) of participants do not think that the flu is severe enough for them to need a vaccine, suggesting a perception that the risk or impact of the flu is not significant. A small percentage (5; 5.05%) of participants believe they will contract the flu from the vaccine, reflecting a misconception about the nature of the influenza vaccine. The 'other' reasons included "I have no reason for not getting vaccinated", "when I plan to get vaccinated, I always already have the flu", and "scared of needles".

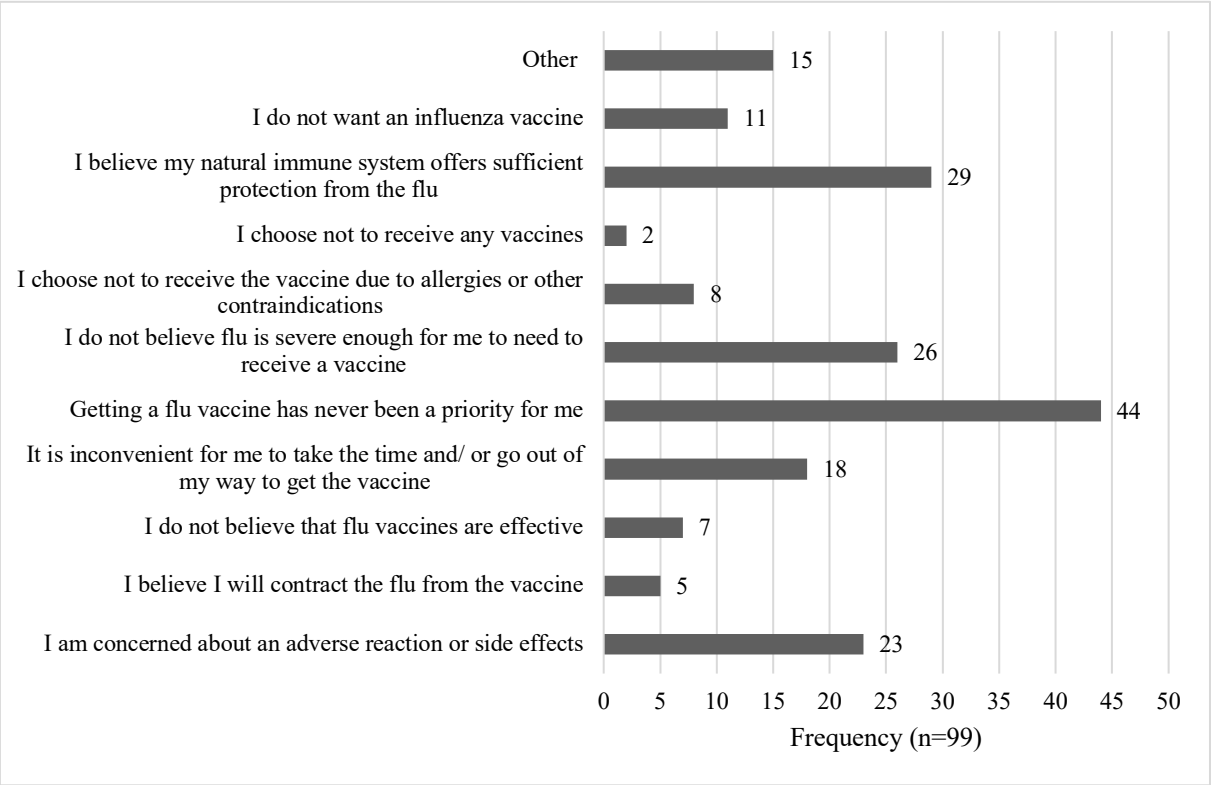


Figure 4.3 Reasons participants gave for not being vaccinated

Table 4.8 shows no significant correlations between knowledge and attitudes, knowledge, and beliefs but significance between attitudes and beliefs.

Table 4.8 Correlation between knowledge, attitudes, and beliefs

Variable	Correlation coefficient	P-value
Knowledge-Attitudes	0.12	0.08
Knowledge-Beliefs	-0.03	0.67
Attitudes-Beliefs	0.48	<0.01*

*Significant $p<0.05$

CHAPTER 5: DISCUSSION

This chapter discusses the study findings, including their interpretation and implications. It also provides insights into the study's future perspectives, and limitations.

Early education plays a formative role in shaping students' behaviours, attitudes, and beliefs, potentially influencing their development as healthcare providers. This study found that pharmacy students demonstrated sustained high knowledge levels about influenza and the influenza vaccine across different year groups, suggesting the long-term efficacy of early educational interventions on healthcare knowledge.

5.1 Vaccination influencing factors

A significant majority of the participants in this study reported having had the influenza virus at some point in their lives. Despite a high rate of influenza experience, less than half of the participants reported ever being vaccinated for the flu. Rogers, Bahr, and Benjamin (2018) found that although 88% of participants reported having been encouraged to receive the seasonal influenza vaccine, only 43.0% reported receipt. The data in this study suggests a possible association between having medical aid and being vaccinated for influenza. A higher proportion of participants with medical aid reported being vaccinated than those without. However, Rogers, Bahr, and Benjamin (2018) found that 59.1% did not receive the vaccine among those with health insurance. Like Ryan *et al.* (2019), this study found that among those who had received an influenza vaccination, nearly half reported receiving the vaccine regularly during childhood, suggesting that a history of childhood vaccination may play a role in adherence to influenza vaccination in adulthood. Interestingly, many participants in this study indicated that their decision regarding current vaccination was not influenced by whether they had been vaccinated in the past.

5.2 Knowledge and vaccination rates

Overall, participants in this study demonstrated strong knowledge about influenza and its vaccine, correctly answering 6 out of 7 knowledge questions (85.7%). This aligns with previous findings like those of Blank *et al*. (2010), who observed high influenza knowledge among healthcare workers, and Ghandora *et al*. (2019), who noted generally strong knowledge among students. Interestingly, Ghandora *et al*. also found that pharmacy students outperformed medical students in their study. Similarly, our study revealed a high understanding of influenza infection (94%) and complications (74.4%).

Importantly, this study suggests a strong correlation between knowledge and vaccination intent. Participants who correctly answered knowledge questions were significantly more likely to consider getting the influenza vaccine. This mirrors the work of Capolongo *et al*. (2006), who found higher knowledge scores associated with increased vaccination likelihood.

However, a persistent misconception remains about the influenza vaccine causing the flu. In our study, participants were almost evenly split on this belief. This parallels findings by Rogers, Bahr, and Benjamin (2018), who reported a similar misconception among students (49.4%). Even more concerningly, Khan et al. (2016) revealed that 64.8% of healthcare workers wrongly believed the vaccine contains a live virus capable of causing illness.

5.3 Attitudes towards mandatory vaccination

More than a quarter of participants indicated that influenza vaccination should be compulsory for pharmacy students. This contrasts with a study where 65.1% of the HCWs indicated that vaccinations should be mandatory (Maltezou *et al.,* 2013), and 70% of the staff supported compulsory vaccination for HCWs working with vulnerable patients (Little *et al.,* 2015). In another study, Kubli *et al.* (2017) investigated first-year pharmacy students' understanding of, attitudes about, and fears surrounding vaccinations before and after receiving vaccination instruction and training. The findings indicated that there was no discernible shift in the percentage of students who thought vaccinations should be elective rather than required between pre-course (49%) and post-course (44%) (Kubli *et al., 2017)*.

Participants stated their main reason for being vaccinated was their education about the vaccine, how it works, and its importance. Conversely, Walker, Newall, and Heywood (2016) reported that 53% of participants indicated that their decision to receive an influenza vaccine was driven by the desire to safeguard patients, while a mere 22.9% cited adhering to national recommendations as the driving force behind their vaccination decision.

5.4 Limitations of this study

As with any study reliant on self-report measures, this study possesses inherent limitations. Participants' reliance on recall for past vaccine decisions introduces the potential for recall bias. While the survey encompassed pharmacy undergraduate students from eight of South Africa's nine pharmacy schools, incomplete response rates preclude full representativeness of the health sciences undergraduate population. Typical of internet-based surveys, the dataset includes incomplete entries. Moreover, data from the pilot study phase were excluded from the primary analysis. Finally, the study did not assess the potential impact of students' concurrent healthcare work experience on their knowledge, risk perceptions, and vaccination decisions.

University student populations tend to cluster within the 18- to 30-year-old age bracket. This age group falls outside the pediatric and geriatric populations, which are recognised for their elevated influenza susceptibility.

In addition, although the response rate was reasonable, the sample size used was only 201 (57,6%) of the 349 minimum recommended sample size; therefore, a larger sample will be more reliable.

CHAPTER 6: CONCLUSION

This chapter presents the conclusions drawn from the study findings and future recommendations.

6.1 Conclusion

The study aimed to investigate the knowledge, attitudes, and beliefs of pharmacy students at nine pharmacy schools in South Africa regarding the influenza vaccine. However, eight universities participated in the study.

This study highlights a complex picture of influenza knowledge, vaccination behaviour, and influencing factors among pharmacy students. Despite a high incidence of self-reported influenza experiences, vaccination rates remain worryingly low. While participants demonstrated above-average knowledge about influenza and vaccines, this knowledge alone did not guarantee vaccination uptake. The persistence of myths, such as the belief that the vaccine can cause influenza, likely contributes to vaccine hesitancy. Interestingly, financial factors like medical aid coverage seem to play a role, but historical vaccination during childhood may have a potential long-term impact on adherence.

Attitudes towards mandatory vaccination for pharmacy students were less supportive than those reported in studies involving other healthcare professionals. This suggests a unique perspective within pharmacy education that warrants further exploration. Crucially, the study indicates that focused education about influenza and vaccines has the potential to positively shift vaccination behaviours, emphasising the importance of targeted interventions within pharmacy curricula.

These findings underscore the need for multifaceted approaches to increase influenza vaccination rates among pharmacy students. Strategies should include proactively dispelling common misconceptions about the influenza vaccine, emphasising the pharmacist's role in promoting vaccine uptake to protect themselves and vulnerable patients, engaging students in discussions surrounding mandatory vaccination policies, and balancing personal autonomy with public health considerations. Further research is needed to explore the specific barriers to vaccination among this population and to develop effective, evidence-based interventions to increase influenza vaccination rates and improve overall public health.

6.2 Future recommendations

This study's findings suggest a gap between awareness of influenza and actual vaccination behaviour; many factors play a more significant role in vaccination decisions among this population group. They also highlight the prevalence of influenza among this population and the potential impact of vaccination programs. Therefore, further investigation is warranted to explore the possible influence of healthcare access on vaccination behaviour.

It is recommended that the universities implement health campaigns that students can participate in to prevent the spread of influenza, especially before the flu season in April/May. This will protect staff and students, as universities are public spaces where students from all faculties interact. Moreover, universities with health science faculty and students taking part in clinical rotations are in constant contact with patients and would benefit greatly from extra protection against influenza. Due to the highly social nature of the current generation of Gen Z, it is also possible that students will be more likely to vaccinate if they see their peers are also participating. Universities may also consider partnerships with the National Department of Health (NdoH) to offer free flu vaccinations around the various campuses. Offering the vaccine on campus at flexible times and without cost removes vital barriers to immunisation, providing students with a convenient, time-efficient, and affordable option. This proactive strategy has the potential to increase vaccine uptake.

To enhance the external validity of these findings within the undergraduate health science student (HSS) context and mitigate potential sampling biases, similar studies should adopt a more inclusive approach by incorporating all relevant programs. This methodological adjustment will promote a more representative analysis of the associations between knowledge, perceived risk, and influenza vaccine uptake.

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APPENDICES

APPENDIX I: Participant Information Sheet



UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

DEPARTMENT OF PHARMACY AND PHARMACOLOGY

PARTICIPANT INFORMATION SHEET FOR A SURVEY UNDERTAKEN AT PHARMACY SCHOOLS IN SOUTH AFRICA.

Name of Principle Investigator:	Princess Moyo
Name of Organization:	Department of Pharmacy and Pharmacology School of Therapeutic Sciences Faculty of Health Sciences University of the Witwatersrand, Johannesburg
Name of Project:	Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa

Dear Sir or Madam,

This is an invitation to participate in a study conducted by researchers at the University of the Witwatersrand. The purpose of the research is to determine the knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in all nine-pharmacy schools in South Africa.

I am Princess Moyo, a postgraduate student at the University of the Witwatersrand, in the Department of Pharmacy and Pharmacology. I am conducting research on the knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination. I am completing a survey under the supervision of Dr. Neelaveni Padayachee (University of the Witwatersrand). I am going to give you information with regard to the content of this survey, and invite you to be a part of this research. I would appreciate it if you could give 5 minutes of your time. You are more than welcome to refuse to take part in this survey.

If the participant information sheet or questionnaire contains anything that is not clearly understood or should you have any further questions later, you are more than welcome to contact me.

Purpose of the research

Influenza is a viral respiratory illness that affects all age groups worldwide. With reports of more than 56,000 hospitalizations and 11,000 fatalities from influenza each year in South Africa, it is necessary that measures to decrease the spread of this virus be implemented. One such measure is the use of the influenza vaccine by healthcare workers (HCWs). This study aims to investigate the knowledge, attitudes and beliefs of undergraduate pharmacy students towards influenza vaccination in nine pharmacy schools across South Africa. Pharmacists tend to be the first point of access for many patients in South Africa that would like to self-medicate at the onset of any symptoms they feel are leading to illness. This means that the opinion of a pharmacist is highly valued in the community that they serve and their knowledge, attitudes and beliefs towards influenza vaccination may very well influence their recommendations to patients. The undergraduates will go on to play a crucial role in advising patients on how to stop the spread of diseases, viable therapies, and give immunizations. Additionally, we want to determine what variables will influence vaccination uptake and refusal in South Africa.

Type of Research Intervention

This research will involve your participation by answering 34 questions about your knowledge, attitudes and beliefs towards influenza vaccination. The questionnaire will be available online via a link to the Research Electronic Data Capture (REDCap) site. REDCap is a secure web application for building and managing online surveys and databases.

Participant Selection

You are invited to take part in this research because you are enrolled as student for the Bachelor of Pharmacy degree at one of the following universities:

- University of KwaZulu-Natal
- University of Limpopo
- University of the Western Cape
- Tshwane University of Technology
- Nelson Mandela University
- Sefako Makgatho University
- Rhodes University
- North-west University
- University of the Witwatersrand

Your participation in this research is voluntary and you may change your mind at any stage throughout the process and can stop participating at any time, up to the point of submission (as here are no identifiers requested, it will be impossible to retrieve an application after submission).

Duration

Data will be collected over one to three month/s in total. During that time, students interested in participating in the study will be given a link to the questionnaire to complete. I will not need any follow ups with the participants, as the information provided through answering of the questions posed in the questionnaire will provide sufficient information.

Risks

There are minimal risks associated with participating in this study. Simply 10 to 15 minutes of your time would be required for completion of the questionnaire. I am asking you to share information with me regarding your influenza vaccine use, which may be considered confidential information. Please be aware that you do not have to answer any question or take part in the survey if you do not wish to do so.

Reimbursements

You will not be provided any incentive or direct benefit to take part in the research. However, we would highly appreciate your time to participate in the study.

Confidentiality

I will not be sharing information about you to anyone outside of the research team. The information that I collect from this research project will be kept confidential. The results from the survey will be stored on REDcap and will be password protected. Only the researcher and the supervisor will have access to the password thereby maintaining confidentiality and security of data.

Sharing the results

The information that you share with us will be used for the purposes of research that will be published, but it will not include your personal information. We will also provide a results summary, free of charge, on request to those interested.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in the study at any time up to the point of submission. Unfortunately, once you submit there will be no way to retrieve your specific questionnaire as there are no identifiers.

Who to contact

If you have any questions, you can ask the researchers/supervisors now or later. If you wish to ask questions later, you may contact any of the following persons:

- Princess Moyo (147488@students.wits.ac.za/ 082 419 4388)
- Dr. Neelaveni Padayachee (neelaveni.padayachee@wits.ac.za/ 011 717 2269)

This proposal has been reviewed and approved by the Wits Human Research Ethics Committee (Medical), which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find out more about the committee or you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on the telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za.

Thank you for reading the participant information sheet.

APPENDIX II: Questionnaire Tool



UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

DEPARTMENT OF PHARMACY AND PHARMACOLOGY

A RESEARCH QUESTIONNAIRE, FOR A SURVEY UNDERTAKEN AT PHARMACY SCHOOLS IN SOUTH AFRICA.

Name of Principle Investigator: Princess Moyo

Name of Organization: Department of Pharmacy and Pharmacology
School of Therapeutic Sciences
Faculty of Health Sciences
University of the Witwatersrand, Johannesburg

Name of Project: "Knowledge, attitudes, and beliefs of pharmacy students towards influenza vaccination in South Africa".

QUESTIONNAIRE (ENGLISH)

DEMOGRAPHICS:

1. Age

◯ 18-21 ◯ 22-25 ◯ 26-29 ◯ 30 and above

2. Gender

◯ Male ◯ Female ◯ Other

3. Ethnicity

◯ White ◯ Black ◯ Indian ◯ Coloured ◯ Other

4. Student enrolment

◯ Domestic ◯ International

5. If you are an international student, please specify country of origin

_____

6. Year of study

◯ 1st ◯ 2nd ◯ 3rd ◯ 4th

7. Living arrangement

◯ On campus ◯ Off campus

8. Do you have possess any other tertiary qualifications:

◯ Yes

◯ No

◯ If yes, please specify_____

VACCINATION HISTORY:

9. Do you have medical aid?

◯ Yes ◯ No

10. Have you ever had the influenza virus?

◯ Yes ◯ No

11. Have you ever been vaccinated for influenza?

◯ Yes ◯ No

12. If you answered 'yes' to the previous question, **WHERE** did you receive your vaccine?

◯ A pharmacy (clicks, dischem, etc.) ◯ A public hospital
◯ A private hospital ◯ A clinic
◯ Other (please specify) _____

13. Did you receive influenza vaccines regularly growing up?

◯ Yes ◯ No

14. Has the experience of having received (or not) influenza vaccines growing up influenced your decision regarding whether to get a vaccine now?

◯ Yes ◯ No

15. Do you intend on getting an influenza vaccine next flu season?

◯ Yes ◯ No

KNOWLEDGE:

16. Influenza is a highly contagious virus.

◯ Correct ◯ Incorrect

17. The influenza vaccine is safe.

◯ Correct ◯ Incorrect

18. The influenza vaccine is effective in the prevention of influenza.

◯ Correct ◯ Incorrect

19. Influenza vaccination reduces the risk of patients becoming seriously ill from influenza. and its complications

◯ Correct ◯ Incorrect

20. There is a risk of getting "the flu" from the influenza vaccine.

◯ Correct ◯ Incorrect

21. Serious adverse events from the influenza vaccine are very rare.

◯ Correct ◯ Incorrect

22. The influenza vaccine is contraindicated in people with egg allergies.

◯ Correct ◯ Incorrect

ATTITUDES:

23. There are populations such as infants, and the immuno-compromised who cannot receive an influenza vaccination, and by receiving a vaccination myself, I am helping limit transmission throughout my community.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

24. The influenza vaccine is only minimally effective, and thus not necessary if you are young and healthy.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

25. Vaccines are not important for health care workers.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

26. When I am completing my pharmacy hours, I am at risk of transmitting influenza to patients.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

BELIEFS:

27. As a pharmacy student, annual influenza vaccination is important to me.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

28. Influenza vaccination should be compulsory for pharmacy students.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

29. It is the duty of a healthcare worker to prevent transmission of influenza to patients.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

30. I believe vaccination is the best way to protect myself and others.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

31. I was required to get a flu vaccine (for any reason).

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

32. If I was NOT required to get the flu vaccine, I would NOT have gotten it.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

33. The reason I got the flu vaccine is because

a) Someone I know had the flu recently and I want to protect myself
b) I saw a news report/journal article/advert on the importance of influenza vaccines
c) It was recommended by a health professional
d) A friend encouraged me
e) A parent or relative encouraged me
f) I have been taught about the flu vaccine, how it works and its importance
g) Other (please specify): _____

34. The reason I did NOT get the flu vaccine is because

a) I am concerned about an adverse reaction or side effects
b) I believe I will contract the flu from the vaccine
c) I do not believe that flu vaccines are effective
d) It is inconvenient for me to take the time and/ or go out of my way to get the vaccine
e) Getting a flu vaccine has never been a priority for me
f) I do not believe flu is severe enough for me to need to receive a vaccine
g) I choose not to receive the vaccine due to allergies or other contraindications
h) I choose not to receive any vaccines
i) I believe my natural immune system offers sufficient protection from the flu
j) I do not want an influenza vaccine
k) Other (please specify):_____

APPENDIX III: Permission Letter to Universities example

Department of Pharmacy and Pharmacology
Faculty of Health Sciences I 7 York Road Parktown, 2193 I Johannesburg I South Africa I Tel: +27 11 717 2052

28 September 2022

RE: REQUESTING PERMISSION TO CONDUCT RESEARCH AT THE UNIVERSITY OF THE WITWATERSRAND

Dear Madam/Sir,

My name is Princess Moyo, and I am a master's in pharmacy research candidate, under the supervision of Dr Neelaveni Padayachee, at the Department of Pharmacy and Pharmacology at the University of the Witwatersrand.

I am seeking permission to conduct research at the University of the Witwatersrand and my topic is titled, "***The knowledge, attitudes and beliefs of all pharmacy students towards influenza in South Africa.***"

Influenza is a viral respiratory illness that affects all age groups worldwide. With reports of more than 56,000 hospitalizations and 11,000 fatalities from influenza each year in South Africa, it is necessary that measures to decrease the spread of this virus be implemented. One such measure is the use of the influenza vaccine by healthcare workers (HCWs). Pharmacists tend to be the first point of access for many patients in South Africa that would like to self-medicate at the onset of any symptoms they feel are leading to illness. This means that the opinion of a pharmacist is valued in the community that they serve and their knowledge, attitudes and beliefs towards influenza vaccination. As future pharmacists, the undergraduate pharmacy students will be critical to providing information and educating patients on diseases, viable therapies, and immunizations. Additionally, factors that influence vaccination uptake and refusal amongst pharmacy students will also be investigated.

Therefore, this study aims to investigate the knowledge, attitudes and beliefs of undergraduate pharmacy students towards influenza vaccination in nine pharmacy schools across South Africa, namely:

- University of KwaZulu-Natal
- University of Limpopo
- University of the Western Cape
- Tshwane University of Technology
- Nelson Mandela Metropolitan University
- Sefako Makgatho Health Science University
- Rhodes University

The originality of this study lies in the fact that to the best of our knowledge, no such study has been conducted among the students in the school of pharmacy at these specific universities.

Vaccine attitudes of HCWs have been investigated in diverse contexts and places, and similar studies have been carried out among medical students and HCWs in training. However, few studies have reported on vaccine attitudes among HCWs in training. This underscores the need for such a study as this one that proposes to investigate the knowledge, attitudes and beliefs in this subset of the HCW population. Moreover, the knowledge generated by this proposed study would add to the growing body of available literature on the potential issues that future HCWs may face and provide evidence to mitigate them while they are still in training

This descriptive cross-sectional survey will be undertaken among undergraduate students in all years (1st to 4th year) that are enrolled in the Bachelor of Pharmacy programme. Data will be collected over one to three month/s in total. A link to REDCap will be provided to all students where the questionnaire can be completed. Consent will be given upon joining the REDCap link. No information about the participants or the research will be shared and all details will be kept confidential, whereby only the researcher and supervisor will access to the data. The results from the survey will be stored on REDcap and will be password protected. There will also not be any incentive or direct benefit for participants to partake in the study.

Upon completion of the study, I undertake to provide you with a copy of the full research report. If you require any further information, please do not hesitate to contact me on 082 419 4388 and 1474880@students.wits.ac.za.

Thank you for your time and consideration in this matter.

Yours Sincerely,

Princess Moyo
Principal Researcher
WITS University
Department of Pharmacy and Pharmacology
E: 1474880@students.wits.ac.za
W: 082 419 4388

Dr. Neelaveni Padayachee
Research Supervisor
WITS University
Department of Pharmacy and Pharmacology
E: neelaveni.padayachee@wits.ac.za
W: 011 717 2269

APPENDIX IV: Research Ethics Certificates



TRREE

Zertifikat
Certificat
Certificado
Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

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Princess Moyo

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Archived - Module 2.1 - Research Ethics Evaluation

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of the TRREE training programme in research ethics evaluation

Release Date: 2021/03/05

CID : OW3jiNTay

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

APPROVED BY SIWF FMH ISFM

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[REV : 20220217]



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CID : ISPEnDGdEu

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

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[REV : 20220217]

Supervisor Ethics Training Certificate



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Neelaveni Padayachee

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Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

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APPENDIX V: Human Research Ethics Committee (Medical) Clearance Certificates

University of the Witwatersrand

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Ms P Moyo

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220847

NAME: (Principal Investigator)	Ms P Moyo
DEPARTMENT:	School of Therapeutic Sciences Department of Pharmacy and Pharmacology Division of Pharmacy Medical School University
PROJECT TITLE:	*Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa*
DATE CONSIDERED:	2022/08/26
DECISION:	Approved unconditionally
CONDITIONS:	This approval applies only to the study sites listed in Annex 1 attached Further sites may be added on presentation of evidence of management approval to the HREC (Med)
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	
APPROVED BY:	Dr N Naran, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/11/03

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report.** When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **August** and therefore reports and re-certification will be due in the month of **August** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

04/11/2022
Date

Annex 1

Protocol No. M22/08/47 **Ms P Moyo**

Study sites approved under this Clearance Certificate

Study site	Date of HREC (Med) Approval
Pharmacy Departments at:	
1. Rhodes University	2023/01/27
2. Nelson Mandel University	2023/05/25
3. North West University	2023/05/25
4. Sefako Makgatho University	2023/05/25
5. University of KwaZulu-Natal	2023/01/27
6. University of Limpopo	2023/02/21
7. University of the Western Cape	2022/11/03
8. University of the Witwatersrand, Johannesburg	2022/11/03

Dr CB Penny
Chairperson: HREC (Medical)
University of the Witwatersrand, Johannesburg

Date: 2023/05/25

University of KwaZulu-Natal

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

21 November 2022

Princess Moyo
Department of Pharmacy and Pharmacology
University of Witwatersrand
Email: 1474880@students.wits.ac.za

Dear Princess

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN), towards your postgraduate degree, provided Ethical clearance has been obtained. We note the title of your research project is:

"The knowledge, attitudes and beliefs of all pharmacy students towards influenza in South Africa."

It is noted that you will be constituting your sample as follows:

- With a request for responses on the website. The questionnaire must be placed on the notice system http://notices.ukzn.ac.za. A copy of this letter (Gatekeeper's approval) must be simultaneously sent to (govenderlog@ukzn.ac.za) or (ramkissoonb@ukzn.ac.za).

Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using the 'Microsoft Outlook' address book. Identity numbers and email addresses of individuals are not a matter of public record and are protected according to Section 14 of the South African Constitution, as well as the Protection of Public Information Act. For the release of such information over to yourself for research purposes, the University of KwaZulu-Natal will need express consent from the relevant data subjects. Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

Dr KE CLELAND: REGISTRAR

University of the Western Cape

UNIVERSITY OF THE WESTERN CAPE
PERMISSION TO CONDUCT RESEARCH

DEAR **Princess Moyo**

This serves as acknowledgement that you have obtained and presented the necessary ethical clearance and your institutional permission required to proceed with the project referenced below:

RESEARCH TOPIC

Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa

Name of researcher	:	Princess Moyo
Permission valid till	:	19 June 2023
Institution	:	University of the Witwatersrand
Ethics reference	:	M220847
Permission reference	:	UWCRP130792

You are required to engage this office (researchperm@uwc.ac.za) in advance if there is a need to continue with research outside of the stipulated period. The manner in which you conduct your research must be guided by the conditions set out in the annexed agreement: Conditions to guide research conducted at the University of the Western Cape.

Please be at liberty to contact this office should you require any assistance to conduct your research or require access to either staff or student contact information.

Regards
Dr Ahmed Shaikjee
Deputy Registrar Academic Administration

Approval status: **APPROVED** 5 October 2022

To verify or confirm the authenticity of this document please contact the University at researchperm@uwc.ac.za.

UNIVERSITY OF THE WESTERN CAPE
Robert Sobukwe Road, Bellville, 7535, Republic of South Africa

Rhodes University

RHODES UNIVERSITY
Where leaders learn

Rhodes University Human Research Ethics Committee
PO Box 94, Makhanda, 6149 South Africa
Email: ethics-committee@ru.ac.za

www.ru.ac.za/research/research/ethics
NHREC Registration No. REC-241114-045

24 November 2022

Ms Princess Moyo
Department of Pharmacy & Pharmacology
University of the Witwatersrand

Dear Ms Moyo

Wits Research Ethics Clearance Number: M22/08/47

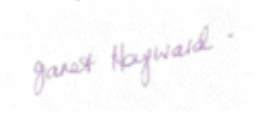
Research Project: "The knowledge, attitudes and beliefs of all pharmacy students towards influenza in South Africa."

This letter confirms that the above research proposal has been reviewed and **APPROVED** by the Rhodes University Human Research Ethics Committee.

Please ensure that the RUHREC is notified should any substantive change(s) be made, for whatever reason, during the research process.

This approval is valid from 24 November 2022 to 24 November 2023.

Sincerely,



Dr Janet Hayward
Chair: Rhodes University Human Research Ethics Committee

University of Limpopo

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 4713, Fax: (015) 268 2306, Email: moore.hutamo@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 09 JANUARY 2023

PROJECT NUMBER: TREC/41/2023: PG

PROJECT:

Title:	Knowledge, attitudes, and beliefs of pharmacy students towards influenza vaccination in South Africa.
Researcher:	P Moyo
Supervisor:	Dr N Padayachee
Co-supervisor:	N/A
Institution:	University of the Witwatersrand
Degree:	Master of Pharmacy

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

Nelson Mandela University

NELSON MANDELA
UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 3624
Dalray.Gradidge@mandela.ac.za

NHREC registration nr: REC-042508-025

Ref: [H22-HEA-PHA-EAP-002] / Approval: 22 February 2023 – 22 February 2024

22 February 2023

Dear Dr Padayachee

KNOWLEDGE, ATTITUDES AND BELIEFS OF PHARMACY STUDENTS TOWARDS INFLUENZA IN SOUTH AFRICA

PRP: Dr N Padayachee
PI: Ms P Moyo

Your application for ethics approval to conduct research at Nelson Mandela University has been considered by the REC-H on the basis that the study has been duly vetted and approved by the Wits University, Research Ethics Committee.

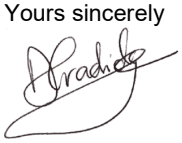
Kindly use the following ethics reference number **H22-HEA-PHA-EAP-002** together with your University's ethics clearance number in any correspondence with gatekeepers and participants at the University. Ethics clearance is valid for one year.

Please inform the REC-H, of any changes that may arise during the execution of the study, particularly to the methodology.

It must be noted that the Nelson Mandela University assumes that the Research Ethics Committee responsible for providing the original ethics approval/clearance has undertaken both ethics and scientific review of the protocol according to the National Health Research Ethics Committee (2015) Guidelines, and assumes primary responsibility for oversight with regard to any ethical issues that may arise in the course of the study. The Nelson Mandela University would also wish to be provided with an executive summary of the findings from the research.

We wish you well with the project.

Yours sincerely



Dr D Gradidge
Chairperson: Research Ethics Committee (Human)

cc: Department of Research Development

North-West University

Private Bag X6001, Potchefstroom
South Africa 2520
Tel: +2718 299-1111/2222
Web: http://www.nwu.ac.za
Research Data Gatekeeper Committee

NWU RDGC PERMISSION GRANTED LETTER

Based on the documentation provided by the researcher specified below, on **17- March- 2023** the North-West University (NWU) Research Data Gatekeeper Committee (NWU-RDGC) hereby **grants permission** for the specific project (as indicated below) to be conducted at the NWU:

Project title: Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa

Project leader: Dr Neelaveni Padayachee

Researcher/Project Team: Ms Princess Moyo

Ethics reference no: M220847

NWU RDGC reference no: NWU-GK-23-125

Approval date: 17- March- 2023 **Expiry date:** 18- March- 2024

General Conditions of Approval:

- The NWU-RDGC will not take the responsibility to recruit research participants or to gather data on behalf of the researcher. This committee can therefore not guarantee the participation of our relevant stakeholders.
- Any changes to the research protocol within the permission period (for a maximum of 1 year) must be communicated to the NWU-RDGC. Failure to do so will lead to withdrawal of the permission.
- The NWU-RDGC should be provided with a report or document in which the results of said project are disseminated.
- Due to the COVID-19 pandemics the Committee would like to advice the researcher to practice the necessary caution and adhere to the National Covid-19 Guidelines when conducting research with participants.

Please note that under no circumstances will any personal information of possible research subjects be provided to the researcher by the NWU RDGC. The NWU complies with the Promotion of Access to Information Act 2 of 2000 (PAIA) as well as the Protection of Personal Information Act 4 of 2013 (POPI). For an application to access such information please contact Ms Annamarie De Kock (018 285 2771) for the relevant enquiry form or more information on how the NWU complies with PAIA and POPI.

The NWU RDGC would like to remain at your service as scientist and researcher and wishes you well with your project. Please do not hesitate to contact the NWU RDGC for any further enquiries or requests for assistance.

Prof Jeffrey Mphahlele

Chairperson NWU Research Data Gatekeeper Committee

Original details: (22351600) C:\Users\22351600\Desktop\test 2.docm
13 November 2018

Current details: (22351600) M:\DSW\RES\Monitoring and Reporting Cluster\Ethical\Applications RDGC\Updated RDGC Permission Letter.docm
15 November 2018

File reference: 1.1.4.3

Sefako Makgatho Health Sciences University

SEFAKO MAKGATHO
HEALTH SCIENCES UNIVERSITY

Research & innovation

Ms P Moyo
Department of Pharmacy & Pharmacology
University of the Witwatersrand
MPharm Candidate

Ref: **M220847**

09 February 2023

To whom it may concern,

Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa

This letter confirms that the abovementioned study has received approval to be conducted on the university premises, and staff and students will be invited to participate.

Where research is conducted that involves specific cohorts, year groups or courses from Schools, the approvals from the Heads of Department or individual academics must be obtained so that appropriate arrangements for access may be made.

In conducting the research, the researcher agrees to adhere to all university regulations for the responsible conduct of research and will always consider participant rights to withdraw without any negative consequence.

This letter, together with the Ethics Clearance Certificate and/or site approval letter from the Sefako Makgatho University Research Ethics Committee (SMUREC) must be available for all research conducted at the university. A copy of the outcomes/ publication must kindly be submitted to the Sefako Makgatho Health Sciences University on completion of the study.

Sincerely

Pp:

PROF M SEHERI
DIRECTOR: RESEARCH & INNOVATION

Research & Innovation
Sefako Makgatho University Research Ethics Committee (SMUREC)

Ms P Moyo
University of Witwatersrand
Department of Pharmacy & Pharmacology
Faculty of Health Sciences

Dear Ms Moyo

RE: MS P MOYO– PERMISSION TO COLLECT DATA AT SEFAKO MAKGATHO HEALTH SCIENCES UNIVERSITY

SMUREC **NOTED** an e-mail dated 07 February 2023 requesting permission to conduct a study at SMU, and all required documents were received as attachments.

SMUREC **NOTED** that the researcher has already received provisional ethics clearance from the University of Witwatersrand, Human Research Ethics Committee, and is awaiting gatekeeper permissions to access students.

Title:	Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa
Researcher:	Ms P Moyo
Supervisor:	Dr N Padayachee
Institution:	University of Witwatersrand
Department:	Pharmacy & Pharmacology
Protocol reference number:	M220847
Type of Research:	MPharm
Date of Approval:	03 November 2022

SMUREC provided reciprocal **APPROVAL** for the above mentioned study to be conducted at SMU.

Yours Sincerely,

PROF C BAKER
CHAIRPERSON SMUREC

09 February 2023

Molotlegi Street, Ga-Rankuwa
Pretoria, Gauteng
PO Box 163, Medunsa, 0204
www.smu.ac.za

Telephone: +27 12 521 5617 / 3698
Facsimile: +27 12 521 3749

Email: lorato.phiri@smu.ac.za

APPENDIX VI: Protocol Approval of Title Letter

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

06 January 2023
Person No: 1474880
PAG

Miss PA Moyo
24 Orion Street
Kensington
2094
South Africa

Dear Miss Princess Moyo

Master of Pharmacy: Approval of Title

We have pleasure in advising that your proposal entitled *Knowledge, attitudes, and beliefs of pharmacy students towards influenza vaccination in South Africa* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

APPENDIX VII: Copy of Approved Protocol

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

CANDIDATE'S SURNAME: MOYO	FIRST NAME/S: PRINCESS	STUDENT NUMBER: 1474880
CURRENT QUALIFICATIONS: BACHELOR OF PHARMACY		
TEL: NONE / CELL: 0824194388 / EMAIL: 1474880@STUDENTS.WITS.AC.ZA / FAX: NONE		
DEGREE FOR WHICH PROTOCOL IS BEING SUBMITTED: MASTER OF PHARMACY		
PART-TIME OR FULL-TIME: FULL-TIME	Sex: (F) M	
FIRST REGISTERED FOR THIS DEGREE 2022	TERM: FULL-TIME	YEAR: 2022
DEPARTMENT: PHARMACY AND PHARMACOLOGY		
TITLE OF PROPOSED RESEARCH: Knowledge, attitudes, and beliefs of pharmacy students towards influenza vaccination in South Africa		
CANDIDATE SIGNATURE: NMoyo		DATE: 28 September 2022
SUPERVISOR 1 (NAME & SURNAME): Neelaveni Padayachee		% Supervision: 100%
SUPERVISOR'S QUALIFICATIONS: BSc, BPharm, MPharm, PhD		
SUPERVISOR'S DEPARTMENT: Pharmacy and Pharmacology		
SUPERVISOR'S ADDRESS / TEL. / E-MAIL: University of Witwatersrand, Medical School, Faculty of Health Sciences, 7 York Rd, Parktown, Johannesburg, 2193, South Africa neelaveni.padayachee@wits.ac.za 0117172269		
WITS ETHICS NOT REQUIRED: Yes No WITS ETHICS PENDING: Yes No WITS ETHICS APPROVED: (Yes) No (circle appropriate symbol)* ***Please note the final human ethics clearance certificate or animal ethics certificate must be available prior to starting research**		IF Y SUPPLY ETHICS CLEARANCE CERTIFICATE AS ATTACHMENT AND INCLUDE ETHICS NUMBER HERE: **M220847**
As supervisor/s, I/we confirm that I have read the protocol which has been submitted for assessment.		
SIGNATURE OF SUPERVISOR/S:	Padayachee	
PROTOCOL ACCEPTED BY HEAD OF DEPARTMENT/RESEARCH COORDINATOR	SIGNATURE:	DATE: 28 September 2022
SIGNATURE PG OFFICE STAFF	REGISTERED: YES..... NO.....	STAMP:

Knowledge, attitudes, and beliefs of pharmacy students towards influenza vaccination in South Africa

1. Introduction

Influenza (flu) is a viral respiratory illness that affects all age groups worldwide. It has a significant yearly burden on morbidity, hospitalizations, and fatalities (Awaidy *et al*., 2020). According to the World Health Organisation (WHO), there are one billion cases of influenza worldwide each year, with 3-5 million of those cases being severe (WHO, 2019) whilst more than 56,000 hospitalizations and 11,000 fatalities from influenza are reported in South Africa each year, inflicting a significant financial strain on both the healthcare system and individual households (Edoka *et al*., 2021). Healthcare workers (HCWs) may be at greater occupational risk of contracting the flu than the public, which could lead to hospital outbreaks and increased absenteeism that disrupts medical services (Awaidy *et al*., 2020). The Strategic Advisory Group of Experts on Immunization (SAGE) noted that there is evidence that the influenza virus is transmitted from HCWs to patients, especially those who are at higher risk of developing severe illness. This includes people (such as babies, the elderly, and those with immunosuppressive diseases) who do not develop an adequate immunological response to the influenza vaccine (SAGE working group, 2012). To sustain healthcare services during influenza epidemics and to safeguard vulnerable patients, it was suggested that HCWs be given priority status as a group that should receive influenza vaccinations.

Although vaccination is frequently mentioned as one of the most efficient approaches to managing infectious illnesses, an increasing percentage of people believe that vaccination is risky and unnecessary (Dubé *et al*., 2013). Parents delaying their child's vaccinations, teenagers (or their parents) opting out of the human papillomavirus (HPV) vaccine, pregnant women opting out of

influenza or pertussis vaccine, the elderly opting out of influenza or shingles vaccine, and even HCWs opting out of the influenza vaccine are examples of reluctant people (Paterson *et al*., 2016). Others take their time, weighing the benefits and risks of vaccination, speaking with family, friends, or members of their community, conducting research online, and seeking advice from their health care provider. Some people choose to get vaccinated right away because they believe it to be the norm, while others wait, weighing the benefits and risks of vaccination (Paterson *et al*., 2016).

The WHO included vaccine hesitancy as one of the ten leading threats to global health (WHO, 2019b) and hesitance by HCWs may cause a threat to global efforts to keep vaccine-preventable diseases at bay. The WHO SAGE on Immunization has mapped the many causes of vaccination reluctance, and the term of vaccine hesitancy that follows was created:

"Vaccine hesitancy refers to a delay in acceptance or refusal of vaccination despite the availability of vaccination services. Vaccine hesitancy is complex and context-specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence" (WHO, 2014).

Some HCWs have said that patients' vaccination decisions are also their own (Baron-Epel *et al*., 2012). Although the HCWs in the United Kingdom (UK) who were not immunized similarly saw vaccination as a personal decision, they acknowledged that influenza was a public health concern and said they should suggest the vaccine without letting their own preferences affect the guidance they offer to patients (Marcu *et al*., 2015). However, several studies have clearly demonstrated the significance of HCW vaccination recommendations in the decision-making process. According to research conducted in the UK, nurses who had received the flu vaccination were significantly more inclined to suggest it to their patients. They also reported understanding the benefits of the vaccine (Zhang *et al*., 2010). Similar findings from research conducted in Nigeria showed that nurses would prescribe immunization if they were willing to receive it themselves (Makwe and Anorlu,

2011). Another study conducted in Canada discovered that previously immunized midwives were more inclined to believe in the security and effectiveness of the influenza vaccine and advise immunization of their patients (Lee *et al*., 2005).

Community pharmacists tend to be the first point of access for many patients that would like to self-medicate at the onset of any symptoms they feel are leading to illness. This means that the opinion of a pharmacist is highly valued in the community that they serve. Indiana State University's *Introduction to Public Communication's* textbook defines attitudes as "an individual's general predisposition toward something as being good or bad, right or wrong, or negative or positive"(Johnston *et al.*, 2017). It also goes on to define beliefs as "propositions or positions that an individual holds as true or false without positive knowledge or proof", therefore the knowledge, attitudes and beliefs of future pharmacist towards influenza vaccination may very well influence their recommendations to patients.

Pharmacy students are the future pharmacists that will serve various communities and there is need to assess influenza vaccine acceptability in this priority group since HCWs are widely involved in and significant advocates for different vaccination initiatives, especially now that the world is dealing with the coronavirus disease (COVID-19) pandemic. As the future of South Africa's healthcare system will be largely composed of pharmacy students, we will begin by evaluating their understanding of and acceptance of the influenza vaccination. The undergraduates will go on to play a crucial role in advising patients on how to stop the spread of diseases, viable therapies, and give immunizations. Additionally, we want to determine what variables will influence vaccination uptake and refusal in South Africa. If problems are found, the results should aid in formulating a working hypothesis for more extended measures to raise vaccination rates in South Africa in the future.

Investigations into the attitudes of HCWs about vaccinations have been place in a variety of settings, and studies with medical students and HCWs in training have been conducted similarly (Oduwole, 2021a). Few studies, nevertheless, have examined how HCWs in training feel about the flu vaccine. This highlights the necessity of a study like this one, which seeks to look at the knowledge, attitudes, and beliefs of this subset of HCWs. This will be an important piece of the puzzle in understanding how this group feels about getting vaccinated against the flu, and it will also help us understand how the general South African community feels about it.

This study is unique because, to the greatest of our knowledge, no other research has ever been carried out among students at the schools of pharmacy at the following institutions: University of the Witwatersrand (WITS), University of KwaZulu-Natal (UKZN), Tshwane University of Technology (TUT), North-West University (NWU), University of Limpopo (UL), Nelson Mandela University (NMU), Sefako Makgatho Health Sciences University (SMU), Rhodes University (RU) and University of the Western Cape (UWC).

The creation of a baseline understanding of influenza vaccination in the research population and the identification of influenza vaccine concerns among aspiring medical professionals are only two examples of the predicted study impact. This would help set the groundwork for the creation of specialized interventions by relevant authorities to address such concerns. Additionally, the information created by this planned research would contribute to the expanding volume of literature that is already accessible on the potential problems that future HCWs could encounter and offer proof of how to solve them while they are still in training.

2. Aim and objectives of the study

What percentage of students enrolled in South African academic institutions currently accept the influenza vaccine? The aforementioned research question is what the suggested study aims to address.

This study aims to understand the knowledge, attitudes and beliefs of undergraduate pharmacy students on the influenza vaccine from the nine pharmacy schools in South Africa.

The objectives of the study are:

2.1. To determine the knowledge of the influenza virus and influenza vaccine among the first, second, third and fourth year pharmacy students.

2.2. To determine the attitudes around influenza vaccination among the first, second, third and fourth year pharmacy students.

2.3. To determine the beliefs of the influenza virus and influenza vaccine among the first, second, third and fourth year pharmacy students.

2.4. To identify and analyse relevant correlations from the data that will be collected from first, second, third and fourth year pharmacy students.

3. Methodology

3.1. Study population and study design

This descriptive cross-sectional survey will be undertaken among undergraduate students in all years (1st to 4th year) of the Bachelor of Pharmacy programme. Pharmacists are well positioned to discuss and counsel patients or individuals on vaccines as they have more time available compared to physicians and other healthcare providers (Cassidy *et al*, 2021). Participants will be recruited from WITS, UKZN, TUT, NWU, UL, NMU, UWC, RU and SMU. According to the South African Pharmacy Council's website there are is total of 3969 pharmacy students (Table 1) in the aforementioned universities. International students will not be excluded from this study as relevant correlations may be made from the data collected. The Raosoft software has recommended a minimum required sample size of 351 students across all nine universities based on a population

size of 3969, margin of error of 5% and a confidence level of 95%. The survey will be distributed until maximum saturation and responses are received.

Purposive/judgemental sampling will be used, which is an example of non-probability sampling. This type of sampling allows the researcher to select the sample based on the type of characteristics that are needed in the study; and in this instance, pharmacy students.

Table 1 - Pharmacy students per university

University	1st year	2nd year	3rd year	4th year	Total
NMU	98	105	154	138	495
NWU	633	174	28	17	852
RU	165	164	184	13	526
SMU	74	70	76	37	257
TUT	79	67	53	41	240
UKZN	103	109	98	133	443
UL	83	86	84	64	317
UWC	140	71	59	133	403
WITS	144	117	69	106	436
					3969

3.2. Inclusion criteria

- Willing to participate in the survey and enrolled in a Bachelor of Pharmacy academic programme (all years of study)
- 18 years old and above

3.3. Exclusion criteria

Participant questionnaires with more than 10 questions not answered will be excluded from the data analysis. Students that participate in the pilot study will also be excluded from participating in the study.

3.4. Data collection

A cross-sectional survey and study data will be collected and managed using Research Electronic Data Capture (REDcap) tools hosted at WITS. REDCap is a secure web-based application designed to support data capture for research studies, providing

- An intuitive interface for validated data entry;
- Audit trails for tracking data manipulation and export procedures;
- Automated export procedures for seamless data downloads to common statistical packages;
- Procedures for importing data from external sources (Ryan *et al*., 2019).

The 5C antecedents of vaccination will be used (Betsch *et al.,* 2020) and the questionnaire will consist of open- and closed-ended questions covering demographics, knowledge, attitudes and beliefs towards the influenza vaccine. Open-ended questions will focus on reasons for vaccine refusal, willingness to receive the vaccine and confidence in recommending the vaccine to their current/future patients.

The questionnaire (Appendix B) was adapted to suit the study needs from a similar study on knowledge, attitudes and beliefs on the influenza vaccine among students (Ryan *et al.*,2019). Responses received are expected to generate sufficient data to support research to answer research questions.

3.5. Validity and reliability of the survey tool

An online questionnaire will be used. The questionnaire will be tested in a pilot study. The questionnaire will thus be subjected to content validation. Prior to the start of the survey, a pilot study will review the 34-item questionnaire for grammar, design, and understanding to determine practicality, face validity, and logistics. The pilot study will be conducted among 47 pharmacy students (16 students from first year, 12 students in second year, 10 students in third year and 9 students in fourth year) at WITS. Forty-seven students represent 10% of the population.

The questionnaire will consist of five sections.

- The first section will comprise eight items to gather the demographic information of the participants.
- The second section also entails six items concerning influenza vaccination history.
- The third section will consist of seven items regarding the knowledge of the influenza virus and influenza vaccines. A nominal scale (correct and incorrect) will be provided for the participants' convenience in disclosing their responses. This section will also address objective 2.1.
- The fourth section will include a 5-point Likert scale (strongly disagree, disagree, neutral, agree and strongly agree) to assess students' agreement to four statements on attitudes towards influenza vaccination as per objective 2.2.

- The last part, section five of the questionnaire, will regard the beliefs surrounding their choices on influenza vaccination as stated in objective 2.3. A 5-point Likert scale (strongly disagree, disagree, neither, agree and strongly agree) will also be used here. The last two questions will be multiple choice where the participant can select various answers or explain their answer under the 'other' section.

Department heads of pharmacy practice at the nine pharmacy departments nationally will be contacted via email to request participation. Upon agreement, the HoDs will provide email addresses to the researcher for loading on to the REDCap system. Reminder emails will be sent automatically from REDCap, as a strategy to increase the response rate. The first email will be sent at the three week mark and the second at the five week mark to indicate time left until the survey is closed. The study survey will be opened for a period of six weeks.

3.6. Data analysis and data storage

All statistical analyses will be performed using StataSE 17. Descriptive statistics (frequencies and percentages) will be done for demographic data such as age and gender and key outcomes for all variables. Chi-Square testing will be used to compare group differences in knowledge about the influenza vaccination, with a fixed threshold of significance of $\alpha = 0.05$ and a confidence interval of 95. Attitudes and beliefs will be analysed using the Kruskal-Wallis test
Using multiple linear regression analysis:

- The relationship between the dependent (knowledge, attitude, and beliefs) and independent variables (demographic information) will be shown on a scatterplot to test the linearity assumption.

- The assumption of normal distribution of the errors between observed and predicted values (i.e. the residuals of the regression) will be checked using a histogram or Q-Q plot.
- The independent variables should not be too highly correlated to each other (multicollinearity). Variance Inflation Factor (VIF) command will be used in Stata to test this assumption. VIF values higher than 10 will indicate that multicollinearity is a problem.
- At every level of x, the residuals should have a constant variance (homoscedasticity). To verify homoscedasticity, a scatterplot of the residuals versus the expected values will be used. The distribution should not exhibit any obvious patterns.

Significance will be set to a p-value of less than 0.05.

4. Limitations

The suggested study has limitations, one of which is a probable low response rate, which is a natural restriction of such online surveys. Only 34 questions are included in the short questionnaire, and where multiple-choice options are available, they are provided to encourage quick, accurate, and thorough responses. A minimum of two reminders should be sent out—one after three weeks and another to follow up five weeks after the initial email with the survey link. Responders' bias may also be a potential issue because the instrument is optional, which is a negative. Some survey participants might not want to or be open about their opinions on immunizations. In the survey invitation email, respondents will get guarantees on the confidentiality and anonymity of their responses, as well as the absence of any unfavourable effects from participating or not. Participants in the influenza vaccination program are more likely to respond to this question than respondents who are afraid to get the vaccine. If this problem arises, a weighting approach would be utilized to correct for non-response bias (Prince, 2012).

5. Ethics

Ethical clearance from the Human Research Ethics Committee (HREC) (Medical) will be obtained in the universities where the study will be conducted. A page with the participant information sheet (Appendix A) will be displayed prior to the commencement of the online survey and the participant will be asked to indicate whether they consent to participating in the study. If they select 'no', access to the survey will be denied and the survey will end and thank the participant for their consideration. Completion of the questionnaire will be voluntary and responses will be anonymous. All surveys are confidential and no personal information is requested from any of the participants.

6. Budget

The funding for this study will be received from The University of the Witwatersrand Department of Pharmacy and Pharmacology. The total cost of the research study will amount to R3600.

Table 2 - Study Budget

ITEM	DESCRIPTION	COST (rands)
Printing	Dissertation and articles	~ R 500
Data	Internet required to conduct research/ literature review and access to emails	~ R 2500 (package for 10GB per month for 12 months)
REDCap	Emails sent out with link of survey after exceeding 1000 free emails per sender per month	R 600 (10c/ email)

7. Timing

2022	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Protocol preparation and submission									
Literature review									
Ethics application and approval									
Data collection									

2023	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Data collection												
Data analysis												
Write-up preparation and presentation												

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APPENDIX A: Participant Information Sheet

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

DEPARTMENT OF PHARMACY AND PHARMACOLOGY

PARTICIPANT INFORMATION SHEET FOR A SURVEY UNDERTAKEN AT PHARMACY SCHOOLS IN SOUTH AFRICA.

Name of Principle Investigator:	Princess Moyo
Name of Organization:	Department of Pharmacy and Pharmacology School of Therapeutic Sciences Faculty of Health Sciences University of the Witwatersrand, Johannesburg
Name of Project:	Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa.

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

Dear Sir or Madam,

This is an invitation to participate in a study conducted by researchers at the University of the Witwatersrand. The purpose of the research is to determine the knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in all nine-pharmacy schools in South Africa.

I am Princess Moyo, a postgraduate student at the University of the Witwatersrand, in the Department of Pharmacy and Pharmacology. I am conducting research on the knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination. I am completing a survey under the supervision of Dr. Neelaveni Padayachee (University of the Witwatersrand). I am going to give you information with regard to the content of this survey, and invite you to be a part of this research. I would appreciate it if you could give 5 minutes of your time. You are more than welcome to refuse to take part in this survey.

If the participant information sheet or questionnaire contains anything that is not clearly understood or should you have any further questions later, you are more than welcome to contact me.

Purpose of the research

Influenza is a viral respiratory illness that affects all age groups worldwide. With reports of more than 56,000 hospitalizations and 11,000 fatalities from influenza each year in South Africa, it is necessary that measures to decrease the spread of this virus be implemented. One such measure is the use of the influenza vaccine by healthcare workers (HCWs). This study aims to investigate the knowledge, attitudes and beliefs of undergraduate pharmacy students towards influenza vaccination in nine pharmacy schools across South Africa. Pharmacists tend to be the first point of access for many patients in South Africa that would like to self-medicate at the onset of any

symptoms they feel are leading to illness. This means that the opinion of a pharmacist is highly valued in the community that they serve and their knowledge, attitudes and beliefs towards influenza vaccination may very well influence their recommendations to patients. The undergraduates will go on to play a crucial role in advising patients on how to stop the spread of diseases, viable therapies, and give immunizations. Additionally, we want to determine what variables will influence vaccination uptake and refusal in South Africa.

Type of Research Intervention

This research will involve your participation by answering 34 questions about your knowledge, attitudes and beliefs towards influenza vaccination. The questionnaire will be available online via a link to the Research Electronic Data Capture (REDCap) site. REDCap is a secure web application for building and managing online surveys and databases. Student email lists will be provided by pharmacy head of departments and loaded to REDCap, where emails will automatically be sent out to students.

Participant Selection

You are invited to take part in this research because you are enrolled as student for the Bachelor of Pharmacy degree at one of the following universities:

- University of KwaZulu-Natal
- University of Limpopo
- University of the Western Cape
- Tshwane University of Technology
- Nelson Mandela University
- Sefako Makgatho Health sciences University
- Rhodes University
- North-West University
- University of the Witwatersrand

Your participation in this research is voluntary and you may change your mind at any stage throughout the process and can stop participating at any time, up to the point of submission (as there are no identifiers requested, it will be impossible to retrieve an application after submission).

Duration

Data will be collected over one to three month/s in total. During that time, students interested in participating in the study will be given a link to the questionnaire to complete. I will not need any follow ups with the participants, as the information provided through answering of the questions posed in the questionnaire will provide sufficient information.

Risks

There are minimal risks associated with participating in this study. Simply 10 to 15 minutes of your time would be required for completion of the questionnaire. I am asking you to share information with me regarding your influenza vaccine use, which may be considered confidential information. Please be aware that you do not have to answer any question or take part in the survey if you do not wish to do so.

Reimbursements

You will not be provided any incentive or direct benefit to take part in the research. However, we would highly appreciate your time to participate in the study.

Confidentiality

I will not be sharing information about you to anyone outside of the research team. The information that I collect from this research project will be kept confidential. The results from the survey will be stored on REDcap and will be password protected. Only the researcher and the supervisor will have access to the password thereby maintaining confidentiality and security of data.

Sharing the results

The information that you share with us will be used for the purposes of research that will be published, but it will not include your personal information. Those interested in the findings of the study may request a summary, free of charge, via email using the contact details in the 'who to contact' section below.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in the study at any time up to the point of submission. Unfortunately, once you submit there will be no way to retrieve your specific questionnaire, as there are no identifiers.

Who to contact

If you have any questions, you can ask the researchers/supervisors now or later. If you wish to ask questions later, you may contact any of the following persons:

- Princess Moyo (1474880@students.wits.ac.za / 082 419 4388)
- Dr. Neelaveni Padayachee (neelaveni.padayachee@wits.ac.za / 011 717 2269)

This proposal has been reviewed and approved by the Wits Human Research Ethics Committee (Medical), which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find out more about the committee or you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on the telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za.

Thank you for reading the participant information sheet.

APPENDIX B: Questionnaire tool

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

DEPARTMENT OF PHARMACY AND PHARMACOLOGY

A RESEARCH QUESTIONNAIRE, FOR A SURVEY UNDERTAKEN AT PHARMACY SCHOOLS IN SOUTH AFRICA.

Name of Principle Investigator: Princess Moyo

Name of Organization: Department of Pharmacy and Pharmacology
School of Therapeutic Sciences
Faculty of Health Sciences
University of the Witwatersrand, Johannesburg

Name of Project: "Knowledge, attitudes, and beliefs of pharmacy students towards influenza vaccination in South Africa".

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

QUESTIONNAIRE (ENGLISH)

DEMOGRAPHICS:

1. Age

◯ 18-21 ◯ 22-25 ◯ 26-29 ◯ 30 and above

2. Gender

◯ Male ◯ Female ◯ Other

3. Ethnicity

◯ White ◯ Black ◯ Indian ◯ Coloured ◯ Other

4. Student enrolment

◯ Domestic ◯ International

5. If you are an international student, please specify country of origin

_____

6. Year of study

◯ 1st ◯ 2nd ◯ 3rd ◯ 4th

7. Living arrangement

◯ On campus ◯ Off campus

8. Do you have possess any other tertiary qualifications:

◯ Yes
◯ No
◯ If yes, please specify_____

VACCINATION HISTORY:

9. Do you have medical aid?

◯ Yes ◯ No

10. Have you ever had the influenza virus?

◯ Yes ◯ No

11. Have you ever been vaccinated for influenza?

◯ Yes ◯ No

12. If you answered 'yes' to the previous question, **WHERE** did you receive your vaccine?

◯ A pharmacy (clicks, dischem, etc.) ◯ A public hospital
◯ A private hospital ◯ A clinic
◯ Other (please specify) _____

13. Did you receive influenza vaccines regularly growing up?

◯ Yes ◯ No

14. Has the experience of having received (or not) influenza vaccines growing up influenced your decision regarding whether to get a vaccine now?

◯ Yes ◯ No

15. Do you intend on getting an influenza vaccine next flu season?

◯ Yes ◯ No

KNOWLEDGE:

16. Influenza is a highly contagious virus.
◯ Correct ◯ Incorrect

17. The influenza vaccine is safe.

◯ Correct ◯ Incorrect

18. The influenza vaccine is effective in the prevention of influenza.

◯ Correct ◯ Incorrect

19. Influenza vaccination reduces the risk of patients becoming seriously ill from influenza. and its complications.

◯ Correct ◯ Incorrect

20. There is a risk of getting "the flu" from the influenza vaccine.

◯ Correct ◯ Incorrect

21. Serious adverse events from the influenza vaccine are very rare.

◯ Correct ◯ Incorrect

22. The influenza vaccine is contraindicated (not supposed to be used) in people with egg allergies.

◯ Correct ◯ Incorrect

ATTITUDES:

23. There are populations such as infants, and the immuno-compromised who cannot receive an influenza vaccination, and by receiving a vaccination myself, I am helping limit transmission throughout my community.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

24. The influenza vaccine is only minimally effective, and thus not necessary if you are young and healthy.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

25. Vaccines are not important for health care workers.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

26. When I am completing my pharmacy hours, I am at risk of transmitting influenza to patients.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

BELIEFS:

27. As a pharmacy student, annual influenza vaccinations are important to me.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

28. Influenza vaccination should be compulsory for pharmacy students.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

29. It is the duty of a healthcare worker to prevent transmission of influenza to patients.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

30. I believe vaccination is the best way to protect others and myself.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

31. I was required to get a flu vaccine (for any reason).

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

32. If I was NOT required to get the flu vaccine, I would NOT have gotten it.

◯ Strongly disagree ◯ Disagree ◯ Neutral ◯ Agree ◯ Strongly agree

33. The reason I got the flu vaccine is because

a) Someone I know had the flu recently and I want to protect myself
b) I saw a news report/journal article/advert on the importance of influenza vaccines
c) It was recommended by a health professional
d) A friend encouraged me
e) A parent or relative encouraged me
f) I have been taught about the flu vaccine, how it works and its importance
g) Other (please specify): _____

34. The reason I did NOT get the flu vaccine is because

a) I am concerned about an adverse reaction or side effects
b) I believe I will contract the flu from the vaccine
c) I do not believe that flu vaccines are effective
d) It is inconvenient for me to take the time and/ or go out of my way to get the vaccine
e) Getting a flu vaccine has never been a priority for me

f) I do not believe flu is severe enough for me to need to receive a vaccine
g) I choose not to receive the vaccine due to allergies or other contraindications
h) I choose not to receive any vaccines
i) I believe my natural immune system offers sufficient protection from the flu
j) I do not want an influenza vaccine
k) Other (please specify): _____

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

APPENDIX C: Human Research Ethics Committee (Medical) Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

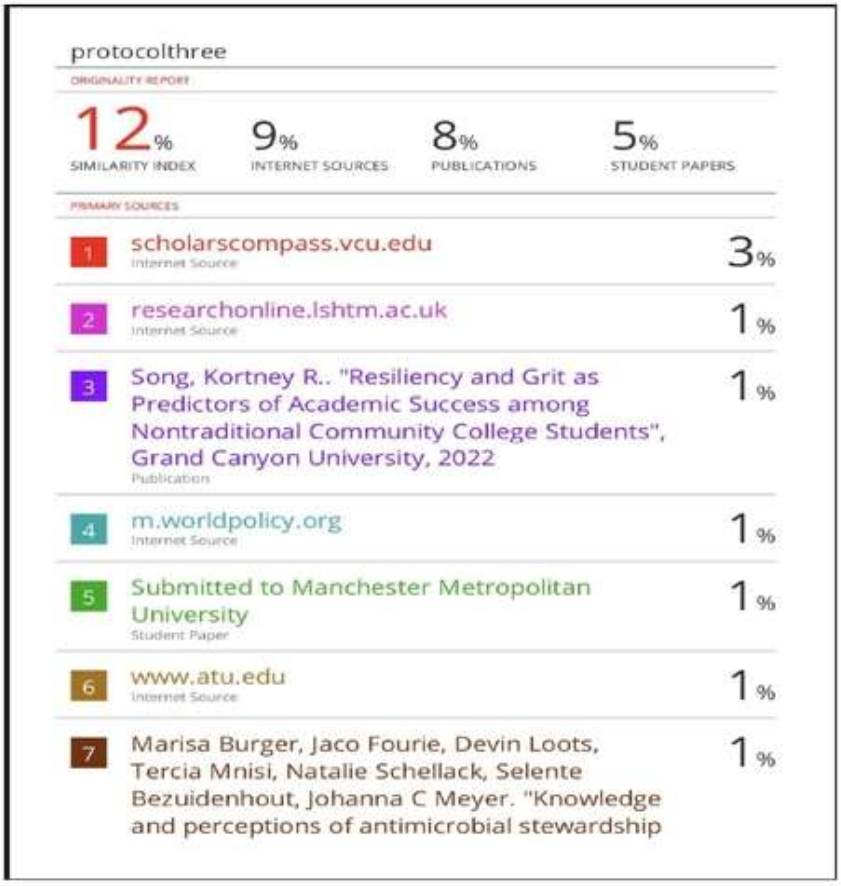
R49 Ms P Moyo

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220847

NAME: (Principal Investigator)	Ms P Moyo
DEPARTMENT:	School of Therapeutic Sciences Department of Pharmacy and Pharmacology Division of Pharmacy Medical School University
PROJECT TITLE:	*Knowledge, attitudes and beliefs of pharmacy students towards influenza vaccination in South Africa*
DATE CONSIDERED:	2022/08/26
DECISION:	Approved unconditionally
CONDITIONS:	This approval applies only to the study sites listed in Annex 1 attached Further sites may be added on presentation of evidence of management approval to the HREC (Med)
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	
APPROVED BY:	Dr N Naran, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/11/03

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

APPENDIX D: TurnItIn Report



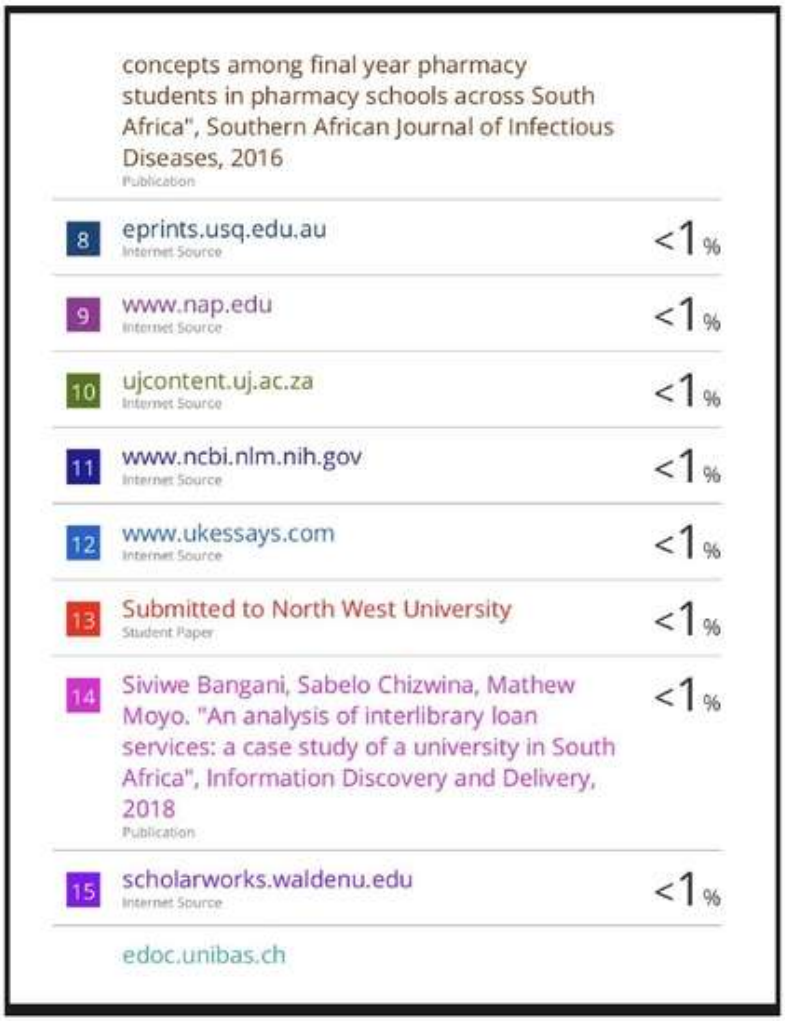
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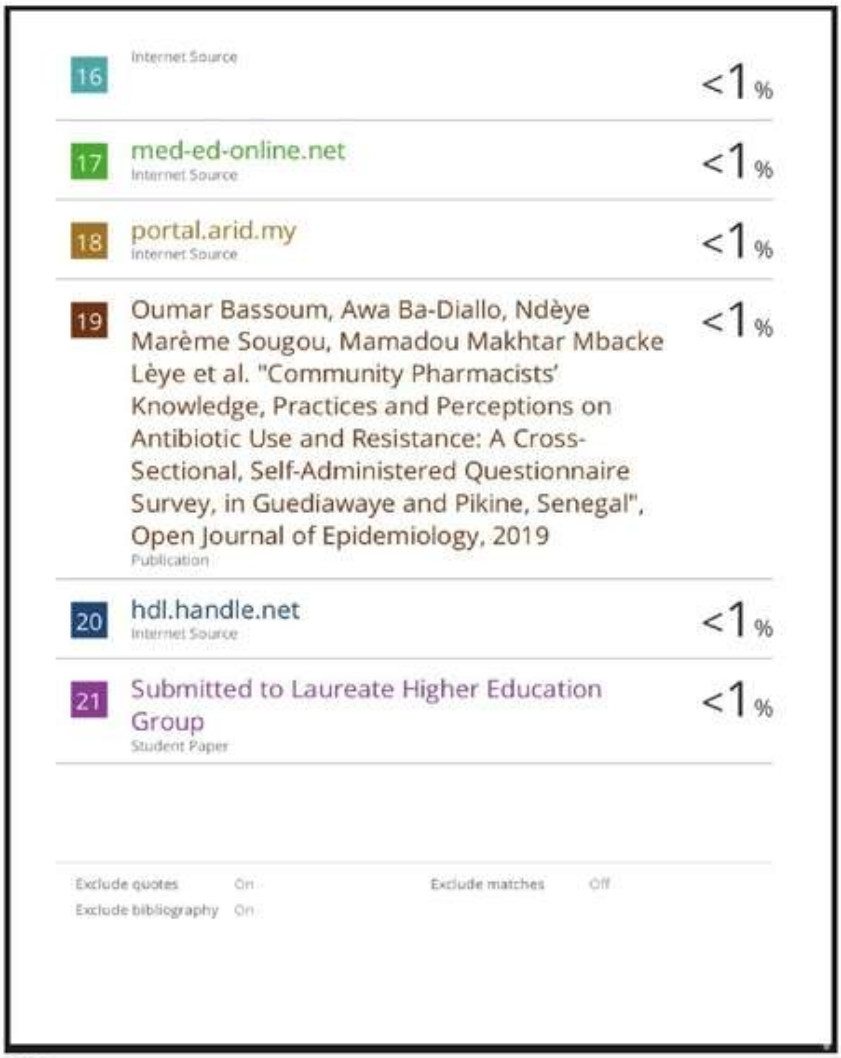
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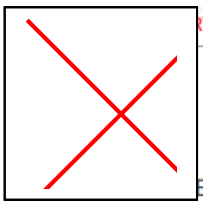
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APPENDIX VIII: Dissertation Plagiarism Report



RT

EX	7% INTERNET SOURCES	5% PUBLICATIONS	3% STUDENT PAPERS

PRIMARY SOURCES

1	Willeman-Buckelew, Dia. "The Relationship between Knowledge and Perceived Risk on Influenza Vaccine Uptake in Undergraduate Health Science Students", Proquest, 2014. Publication	1%
2	www.researchgate.net Internet Source	1%
3	Submitted to University of Witwatersrand Student Paper	<1%
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