Factors associated with adherence to COVID-19 preventive measures among health-careworkers in Eswatini.

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER DEGREE IN PUBLIC HEALTH

DEPARTMENT OF PUBLIC HEALTH

UNIVERSITY OF THE WESTERN CAPE

2022

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Keywords: COVID-19, Health care workers, Adherence, Non pharmaceutical interventions, Preventive, PPE, Risk, Pandemic, Transmission, Eswatini

Abstract

Background: Worldwide, coronavirus disease-19 (COVID-19) created major challenges, becoming a public health emergency and threatening lives; with healthcare workers (HCWs) at an even higher risk of infection due to their occupation. Adherence to recommended preventive measures is a major approach in controlling transmissible diseases like COVID-19. Regardless of repeated consensus that adhering to non-pharmaceutical preventive strategies is of paramount significance in controlling the spread of COVID-19, HCWs' risk perception and poor compliance to COVID-19 preventive measures remain a global challenge. This study assessed the adherence of HCWs to COVID-19 preventive measures and identified factors associated with adherence among HCW at Raleigh Fitkin Memorial (RFM) Hospital in Manzini, Eswatini.

Methods: A quantitative observational descriptive cross-sectional study was conducted among 174 HCWs in non-specialised COVID-19 units at RFM Hospital in Eswatini. Random proportionate to size sampling was used to select HCWs from doctors, nurses, and allied HCWs. A self-administered, web-based questionnaire was used to collect data. The data was entered into an excel spreadsheet, cleaned, coded, and analyzed using SPSS (version 27). A Chi-squared test was used to determine bivariate associations between the independent and dependent variables. Multivariate analyses were performed to examine factors associated with adherence to COVID-19 preventive measures. A Likert scale was used to infer adherence or non-adherence. Ethics approval was granted by the University of the Western Cape's Biomedical Research Committee (Reference number: BM21/10/23) and the National Health Research Review Board in Eswatini (Reference number: EHHRRB099/2021).

Results: Fifty three percent (52.6%, n=90; range = 44.2% - 87.1%) of the participants had good adherence to non-pharmaceutical interventions. Higher adherence levels were recorded on participants who wore face masks when going outside (87.1%; n = 152), those who used a hand sanitizer regularly during the day (85.7%; n = 149), and participants who avoided shaking hands (86.6%; n =151). Lower adherence levels were recorded on participants failing to avoid using personal items like mobile phones (44.1%; n =77), failing to avoid touching the outer surface of the mask while wearing it (62.1%; n = 108), and failing to measure body temperature at least twice a week (64.9%; n=113). The multivariate analyses showed that participants trained on COVID-19 preventive measures were more likely to adhere to COVID-19 non-pharmaceutical preventive measures (OR=7.00, 95%CI 2.17-18.07, p-value 0.00); and that by profession, doctors (OR= 0.43, 95%CI 0.20-0.96, p-value 0.04) and nurses (OR= 0.38, 95%CI 0.18-0.78, p-value 0.01) were less likely to adhere to COVID-19 non-pharmaceutical preventive measures. Adjusting for profession, participants trained on COVID-19 preventive measures were 7.4 times more likely to adhere to COVID-19 non-pharmaceutical preventive measures (AOR=7.42; 95%CI 2.80-19.64, p-value 0.00). Compared to allied healthcare workers, doctors were 58.6% less likely to adhere to COVID-19 non-pharmaceutical preventive measures (AOR=0.41, 95%CI 0.04-0.18, p-value 0.04). Most participants (82.5%, n=141) mentioned that inadequate supplies of appropriate personal protective equipment (PPE), staff shortages (87.7%, n=150), and uncooperative community (83.6%, n=143) were barriers to compliance with COVID-19 non-pharmaceutical preventive measures.

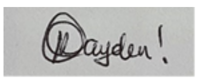
Conclusion: Healthcare workers at RFMH in Manzini have a satisfactory level of adherence to the common non-pharmaceutical COVID-19 preventive measures. Factors affecting adherence included profession and having received training on non-pharmaceutical interventions. The major barriers to adherence to non-pharmaceutical COVID-19 preventive measures included inadequate supplies of PPE, staff shortages, and uncooperative community. Additional research is necessary

on a bigger scale and population to assess the efficacy of these preventive actions in averting virus transmission among HCWs and between patients and HCWs.

Declaration

I declare that '**Factors associated with adherence to COVID-19 preventive measures among health-care workers in Eswatini'** is my own work. This work has not been submitted for any degree or examination in any other university and that all the sources and references I have used or quoted have been indicated and acknowledged by complete references.

Full name: Knowledge Denhere Date: 19 April 2022

Signed: 

Acknowledgements

First and foremost, I would like to express my sincere gratitude to my supervisor Prof Hanani Tabana and co-supervisor Dr Nondumiso BQ Ncube for their continuous support throughout my MPH mini thesis. Their patience, motivation, enthusiasm, and immense knowledge were priceless throughout my studies. Their guidance helped me with carrying out the research project and writing of this thesis.

I would like to express my heartfelt gratitude to Raleigh Fitkin Memorial Hospital's management and staff for participating in this project. It would have not been possible to carry out this project without their support. Additionally, I would like to thank my colleagues Mr Malizan Mhango, Mr Nhema Mudhuza and Dr Millicent Buckhum for their encouragement, insightful comments, stimulating discussions and constructive criticism.

Last but not the least; I would like to express my sincere appreciation to my wife Mrs Hazel Denhere and my son Kayden Temah Denhere to whom I dedicate this work, for supporting me throughout my studies.

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List of abbreviation

AIDS	Acquired Immunodeficiency Syndrome
AOR	Adjusted odds ratio
CDC	Center for Disease Control and Prevention
CI	Confidence Interval
COVID-19	Corona Virus Disease 2019
HCWs	Healthcare workers
HIV	Human Immunodeficiency Virus
IPC	Infection Prevention and Control
IQR	Interquartile range
MoH	Ministry of Health
NPI	Non-Pharmaceutical Interventions
OR	Odds Ratio
PPE	Personal Protective Equipment
RFM	Raleigh Fitkin Memorial
RFMH	Raleigh Fitkin Memorial Hospital
SARS	Severe Acute Respiratory Syndrome
SSA	Sub-Saharan Africa
UWC	University of the Western Cape
WHO	World Health Organisation

Operational definitions

Adherence –The extent to which a person observes and follow the stipulated interventions to prevent the spread of an infection

Healthcare worker – A professional worker in a health institution who provides care and services to patients, either directly such as nurses and doctors or indirectly such as laboratory scientists, pharmacists, physiotherapists and radiographers

Non-pharmaceutical interventions - these are actions, besides taking medications or vaccines that people can undertake to prevent the spread of a transmissible infection during a pandemic

Non-COVID-19 specialized units - these are wards in a healthcare institution where patients with any other disease or condition besides COVID-19 are managed and treated.

Chapter 1: Background

1.1 Introduction

COVID-19 infections among healthcare workers (HCWs) place other HCWs, patients, and the general population at risk of infection (Nhari *et al.*, 2020). Besides vaccines, reducing the exposure of HCWs to the COVID-19 virus is the preeminent alternative for protecting them against COVID-19 infections, and this is best performed through their adherence to preventive interventions against COVID-19 (Kim *et al.*, 2020; Nguyen *et al.*, 2020).

Healthcare workers play a vital part in fighting against the COVID-19 pandemic and are at an increased risk of infection with the virus while executing their duties (Kassie *et al.*, 2020a). Studies have shown that HCWs are most likely to be exposed to the virus and are, thus, at a higher risk of COVID-19 infection than other workers and the general population (Nguyen *et al.*, 2020). The burden and impact of the COVID-19 pandemic have been unprecedented on HCWs. Nevertheless, prevention remains paramount for protecting HCWs against the COVID-19 pandemic (Garralda Fernandez *et al.*, 2021a). As such, adherence to the universally agreed COVID-19 infection preventive measures or protocols is important in reducing HCWs' exposure to COVID-19 (Louise E Smith *et al.*, 2020). Proper and constant compliance with preventive measures is effective in decreasing the risk of COVID-19 infection (Kim *et al.*, 2020). Compliance with preventive measures is improved by training of HCWs on proper donning and doffing of personal protective equipment (PPE), provision of PPE resources, and systematic audit of infection prevention control practices (Garralda Fernandez *et al.*, 2021b). To further reduce transmission of highly infectious diseases like COVID-19, preventive strategies such as source control, early recognition, restriction of movement, physical distancing, observing precautions and proper use of PPEs, surface cleaning and decontamination, as well as support for HCWs have been shown to be beneficial (Verbeek *et al.*, 2020).

Eswatini has instigated the WHO’s non-pharmaceutical interventions (NPI) to fight and reduce the burden of the COVID-19 pandemic (Felix, 2020). Regardless of the reiterated consensus that complying with the NPIs is the most effective approach to prevent the novel coronavirus, HCWs risk perception and poor adherence to COVID-19 preventive measures remain problematic globally (Prem *et al.*, 2020). Devoid of compliance, NPIs will be of no value in accomplishing the anticipated goal. Furthermore, HCWs, and consequently the entire population, will continually be at risk of the COVID-19 infection, a statistic becoming apparent in Eswatini where HCWs have been infected (WHO, 2021). An understanding of factors affecting adherence to COVID-19 NPIs among HCWs is indispensable in preventing the spread of COVID-19 infections among HCWs and decreasing secondary transmission in healthcare facilities.

1.2 Problem statement

There has been an increase in COVID-19 cases and mortality among HCWs in Eswatini since the first eight HCW infections were reported in May 2020 (Felix, 2020). The national publication of 09 February 2021 reported 10 mortalities and a further 317 infections among HCWs between December 2020 and January 2021 (Times of Swaziland, 2021). Another national publication, The Observer, reported that 86 HCWs had died due to COVID-19 and more than 200 staff had tested positive at a single regional referral hospital (The Observer, 2021). A total of 60 nurses, 14 doctors, 10 paramedics, and three support staff were among the fatalities, accounting for 12,8% of the overall COVID-19 fatality rate in Eswatini (The Observer, 2021). Fatalities among HCWs negatively contribute to the existing chronic staff shortages and compromise patient care and management, ultimately affecting the effective execution of clinical duties by remaining HCWs.

This poses a risk of the nation failing to control the COVID-19 pandemic and becoming a reservoir from which the virus could be reintroduced to other countries that might have managed to control infections (El-Sokkary *et al.*, 2021). Poor adherence to COVID-19 preventive interventions has been reported as a major cause of infection among HCWs (Prem *et al.*, 2020). Currently, literature on adherence of HCWs in Eswatini's health institutions, (including Raleigh Fitkin Memorial Hospital (RFMH)), to COVID-19 preventive measures and factors determining adherence to these is scant (Guo *et al.*, 2020). The importance of understanding factors that affect adherence to COVID-19 NPIs among HCWs to decrease HCW-to-HCW COVID-19 infections and infections to patients and the community cannot be overemphasized. This information will be pertinent in updating healthcare facility COVID-19 protocols, and infection prevention and control policies in Eswatini.

1.3 Aim

This study aimed to assess the level of adherence to COVID-19 non-pharmaceutical preventive measures and identify factors associated with adherence among healthcare workers at RFMH in Manzini, Eswatini.

1.4 Objectives

1. To describe the level of adherence to COVID-19 non-pharmaceutical preventive measures by HCWs at RFMH in Manzini, Eswatini.
2. To determine factors associated with adherence to COVID-19 non-pharmaceutical preventive measures at RFMH in Manzini, Eswatini.
3. To make recommendations on adherence to COVID-19 preventive measures to the IPC committee at RFMH in Manzini, Eswatini.

1.5 Rationale

Healthcare workers are important primary workers during outbreaks of communicable infections like COVID-19 (Ahmed *et al.*, 2020). Despite all the NPI instigated, there is increasing evidence showing a high incidence of COVID-19 infection in HCWs than in other professions (Asemahagn, 2020a). This is due to increased exposure time to infected patients and environments contaminated with the virus (Lai *et al.*, 2020). Understanding the practicability of adherence to NPI for COVID-19 prevention among HCWs is important for both health system planning and awareness. This is additionally significant in statistical modeling to predict the further progression of the pandemic at local and national levels (Prem *et al.*, 2020). Studies have analysed the knowledge and attitudes of the general population towards COVID-19 (Erfani *et al.*, 2021; Akalu, Ayelign and Molla, 2020; Reuben *et al.*, 2020; Saqlain *et al.*, 2020; Handebo *et al.*, 2021). However, there is a paucity of literature on factors influencing adherence to COVID-19 preventive measures in HCWs, particularly in Eswatini. This study assessed factors associated with HCWs' adherence to COVID-19 NPIs at RFMH in Manzini, Eswatini.

1.6 Research Question

What are the factors associated with adherence to non-pharmaceutical COVID-19 preventive measures among HCWs at RFMH in Manzini, Eswatini?

1.7 Purpose of study

The purpose of this quantitative study was to advance understanding of the factors associated with non-adherence to non-pharmaceutical COVID-19 preventive measures among HCWs at RFMH in Manzini, Eswatini. Findings from this study could benefit the Ministry of Health in Eswatini by contributing to the development of effective strategies to improve adherence and reduce transmission of COVID-19 among HCWs.

Chapter 2: Literature review

2.1 Introduction

The COVID-19 pandemic was initially reported in sub-Saharan Africa (SSA) in February 2020, after being affirmed a public health emergency by the World Health Organisation (WHO) on 31st January 2020 (WHO, 2021). It was first detected in Eswatini in March 2020. Due to relatively insubstantial healthcare structures and higher levels of poverty in Eswatini, the country faced a complex COVID-19 pandemic, with the potential of becoming a reservoir for the virus, and a source of re-infections even to other nations which might have accomplished its control (Ditekemena, Doumbia and Ebrahim, 2020). Additionally, cultural and economic conditions in the country are contributing factors to propagating the spread of the virus (Kobia and Gitaka, 2020). Poor health infrastructure and shortage of equipment for comprehensive COVID-19 testing similarly prevented the nation from evaluating the factual burden of the pandemic, both at provincial and national levels, and from developing a well-directed approach and sufficient response (Bedford *et al.*, 2020).

Particularly, the absence of effective treatment and a vaccine in the early months of the pandemic made COVID-19 a major public health threat globally (Ditekemena, Doumbia, and Ebrahim, 2020). Even after several vaccines were approved by WHO and FDA, they were not easily obtainable in most African countries, including Eswatini (Mwendwa *et al.*, 2021). Together, these factors pushed the country to cogitate the execution of strict NPIs as a priority in fighting the COVID-19 pandemic (Turk *et al.*, 2021). These NPIs include physical distancing, the compulsory use of face masks in public places, regular hand washing with alcohol-based sanitizers, and the use of alcoholic solutions for disinfection (Siewe Fodjo *et al.*, 2020). Such measures were found to be effective previously in controlling epidemics whose aetiologies, like COVID-19, are members of the respiratory viruses such as Severe Acute Respiratory Syndrome (SARS), influenza, and Middle East respiratory syndrome in Taiwan, Korea, China, and other nations (Drosten *et al.*, 2003; de Groot *et al.*, 2013).

2.2 General risk factors for COVID-19 morbidity and mortality

Most COVID-19 cases present with mild to moderate symptoms and usually recover with supportive care. Severe cases are most expected in the elderly and those with underlying conditions such as chronic pulmonary diseases, diabetes, malignance, and cardiac disease (Fang, Karakiulakis, and Roth, 2020). Earlier, a study in China where the virus was first detected, reported that about 50% of patients had at least one comorbidity, with hypertension being the most predominant (31%), then diabetes (20%) and coronary heart disease (9%) (Zhou *et al.*, 2020). A study in Italy confirmed these findings, reporting that COVID-19 mortalities were prevalent among patients with comorbidities, where most of them were hypertensive (77%) (Day, 2020).

2.3 COVID-19 transmission to HCWs

During the early phases of the pandemic, healthcare facilities were overwhelmed with both symptomatic and asymptomatic cases (Olum *et al.*, 2020). Healthcare workers are central in managing and treating COVID-19 patients, working in close propinquity to the highly communicable virus (Xiang *et al.*, 2020). Moreover, the unpreparedness of healthcare systems plus the novelty of COVID-19 disease made HCWs easy targets for infection. Hospital settings are among the key routes for the secondary transmission of the virus (Bauchner, Fontanarosa, and Livingston, 2020). One of the main reasons for the rapid increase in HCWs infections was the deficiency of precise scientific knowledge on COVID-19, including its pathogenesis, incubation period, virulence factors, resistant strains, and survival outside a host (Tan, 2020). Consequently, leading to infections among HCWs as well as from HCWs to the community. Reports from early studies on viral transmission in Wuhan submitted that most HCWs were unacquainted with the severity and transmissibility of COVID 19, and got infected while managing the COVID-19 cases (Xiang *et al.*, 2020). Additionally, COVID-19 preventive measures involve specialized PPE such as respirators, non-perforated gowns, N-95 masks, and face shields or visors to prevent infections. Due to the unprecedented magnitude of the pandemic worldwide, the supply of these indispensable PPE was inconsistent (Burki, 2020). Besides, almost all the PPEs are for once-off usage and need extreme precaution when doffing to avoid transmission. Hence insufficient supplies and improper use of the PPE are significant factors contributing to COVID-19 infections among HCWs (Burki, 2020). The difficulty and shortage of extensive dependable testing and the ambiguity of the diagnostic standards in the early days of the COVID-19 pandemic are similarly associated with the COVID-19 transmission to HCWs (Wang, Lee, and Zhou, 2020). Equally, fatigue from staff shortages and stressful working environments add to the augmented risk for HCW infections with COVID-19 (Otter, Yezli and French, 2011). Figure 1 illustrates the common factors for COVID-19 transmission in HCWs.

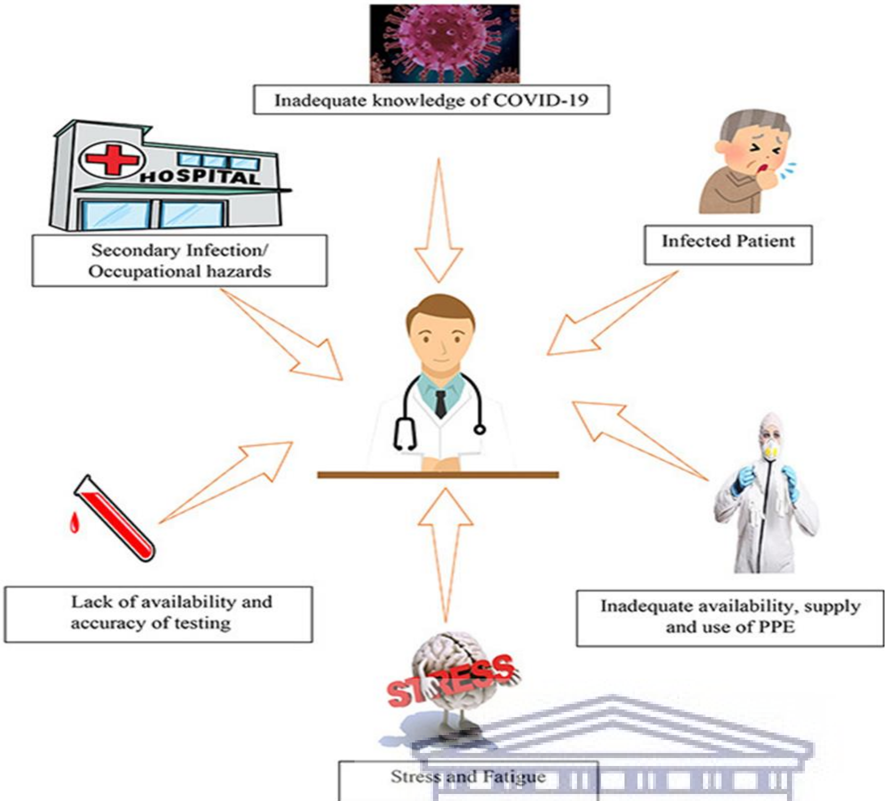

Figure 1: COVID-19 transmission to HCWs

**Adopted from: Alshamrani, M.M.* et al. *(2021)*

2.4 Risk of COVID-19 infection among HCWs

The COVID-19 pandemic poses an unparalleled mental and physical challenge for HCWs globally (Shaukat, Ali, and Razzak, 2020). Healthcare workers are at a higher risk of COVID-19 infection and studies have reported COVID-19 cases amongst HCWs since the beginning of the pandemic (Salazar de Pablo *et al.*, 2020). Averting HCW infection is imperious to reducing morbidity and possible mortality, reducing secondary transmissions, and maintaining health system capacity (Wei *et al.*, 2020). Being at the forefront of treating and managing COVID-19 cases, HCWs have a higher risk of exposure to the virus than the general population (Wei *et al.*, 2020; Zheng *et al.*, 2020). Diseased HCWs could be a source of infection to fellow HCWs, hospitalized patients, their families, and the community in general (Shah *et al.*, 2020; Souadka *et al.*, 2020).

A study showed that HCWs are at a ten-fold higher risk of COVID-19 infection relative to admitted patients in the same facility (Alshamrani *et al.*, 2021). More studies that involved both non-HCWs and HCWs have congruently reported higher risks of COVID-19 infection amongst HCWs, with a range of 1.5 to 12.4 times (Souadka *et al.*, 2020; Wei *et al.*, 2020; Zheng *et al.*, 2020). Nguyen *et al* (2020) conducted a huge survey including approximately 100 000 frontline HCWs and over two million non-HCWs and reported that the probability of returning a positive COVID-19 test was 4% in HCWs while it was 0.3% among non-HCWs (Nguyen *et al*., 2020). The factors predisposing HCWs to higher risks of COVID-19 infection in health facilities include incongruous use or re-use of PPE, unprotected exposure, insufficient hand hygiene, working in higher risk units, higher-risk healthcare practices, and longer working shifts (Chou *et al.*, 2020; Shaukat, Ali and Razzak, 2020). Other factors predisposing HCWs to COVID-19 infection include ineffectively sanitized and cleaned hospital surfaces, compromised decontamination of medical devices, and inadequate training and education about the virus (Bedford *et al.*, 2020). Healthcare workers have reported higher healthcare facility sources of COVID-19 infection, which is possibly associated with exposure to diseased HCWs and non-HCWs (Chou *et al.*, 2020; Shaukat, Ali, and Razzak, 2020). The dissimilarities in accessing testing facilities and cognizance of infection symptoms between HCWs and non-HCWs possibly contribute to the magnified risk of infection in HCWs while underestimating the risk among non-HCWs (Adly *et al.*, 2020).

2.5 COVID-19 Morbidity and mortality among HCWS

The COVID-19 pandemic has affected all nations globally and caused substantial loss of economic output, health, and life. Several countries have implemented similar methods of containing the propagation of COVID-19 (Chang *et al.*, 2022). Nevertheless, all countries exhibit radical variances in COVID-19 related morbidity and mortality, even between nations with comparable political and socio-economic conditions. The case fatality rate for COVID-19 is approximated to range between 0.4–1.1%, with higher fatality rates among the elderly, especially those aged 60 or over (Verity *et al.*, 2020). According to WHO (2022), as of 4 March 2022, about 441 million confirmed cases of COVID-19, and six million deaths were reported to WHO (WHO, 2022). About 160 million cases and 2 million deaths were from Europe, and about 12 million of these cases and 250 000 deaths were from the African Region (Worldometer, 2022). It was reported that approximately 52 million cases and 2.5 million deaths were among HCWs (Worldometer, 2022). On the same date, Eswatini had recorded 69 297 cases and 1 391 deaths (Worldometer, 2022). In 2021, a national publication in Eswatini reported that 12.8% (n = 179) of deaths were among HCWs (The Observer, 2021).

2.6 COVID-19 Preventive measures

The WHO has instigated numerous NPIs including hand washing with running water and soap, sanitization with alcohol-based sanitizers, mask-wearing, physical distancing, cough etiquette, national lockdowns, isolation of cases, and banning of gatherings (Asdaq *et al.*, 2021). These NPIs have been adopted globally and have proven to be effective in reducing the transmission of COVD-19 (Algaissi *et al.*, 2020). The significance of appropriate use of these NPIs is particularly emphasized among HCWs who are at a higher risk of contracting the disease than the rest of the population. A study conducted in India showed a decrease in COVID-19 infections by approximately 91% because of the proper use and adherence to NPIs (Pandey *et al.*, 2021). Furthermore, a study conducted in Canada reported that physical distancing by at least 1 meter, mask-wearing, and face shield usage led to a great decrease in the infection risk in HCWs (Chu *et al.*, 2020). In Eswatini, several unprecedented and stringent precautionary and preventive measures such as banning international travel, and closing churches, restaurants, and schools have been implemented to control COVID-19 (Padidar *et al.*, 2021). Additionally, many recommendations for preventive measures such as working in shifts, staying at home when one has symptoms, using surgical gloves and disposable gowns, and regular surface disinfection have been used to reduce infection among HCWs (Algaissi *et al.*, 2020).

2.7 Adherence to non-pharmaceutical preventive measures

There are wide discrepancies in adherence to COVID-19 NPIs between and within countries (Houghton *et al.*, 2020). A cross-sectional study involving 1035 HCWs in England showed an 80% adherence to the use of PPE, 67.8% adherence to hand hygiene, and 74.7% adherence to physical distancing recommendations (Louise E. Smith *et al.*, 2020). Among 214 HCWs in Saudi Arabia, high adherence to mask usage (82%) and wearing of gloves (95%) were reported, while adherence to regular hand washing was slightly low at 68% (Albeladi *et al.*, 2021). Block and associates (2020) reported that only 73%, 68%, 56%, and 66% of African-Americans adhered to regular hand-washing, maintained physical distancing, avoided touching the face, and wore a mask in public spaces, correspondingly (Block *et al.*, 2020). A survey piloted in the Democratic Republic of Congo (DRC) reported low adherence to NPIs like wearing face masks (45%), physical distancing (58%), regular hand washing (15%), and phone disinfecting (25%) (Diketema *et al.*, 2021). Kassie *et al* (2020) reported an inclusive adherence of 38% among 630 HCWs, with compliance of 43.3% for physical distancing, 37.2% for mask use, 36.2% for avoiding handshakes, and 16% for regularly washing hands. In Ethiopia, Zenibaba *et al* (2021) reported an overall adherence of 21.6% among 644 HCWs in Southeast Ethiopia while Haile, Engeda, and Abdo reported an overall adherence of 12% in Northwest Ethiopia (Haile, Engeda and Abdo, 2021).

2.8 Factors affecting adherence to preventive measures in general populations

Globally, the determinants for adherence are diverse and differ according to region (Elhadi *et al.*, 2020). A large global survey reported women to be considerably more likely to take health precautions, observe preventive measures, and make health commendations to their peers (Clark *et al.*, 2020). Nonetheless, this study reported no association between age and level of adherence, and a very weak correlation between age and health precaution execution (Clark *et al.*, 2020). In Saudi Arabia, there was great adherence to COVID-19 preventive measures for all genders, health statuses, and age groups, with few exemptions (Albeladi *et al.*, 2021). Young adults were less likely to adhere to regular hand washing and maintaining social distance while single people were particularly less compliant with staying at home (Albeladi *et al.*, 2021). Comparable tendencies were observed in Ghana, where all the participants adhered to at least two preventive measures, with even higher levels of adherence among the elderly (Amodan *et al.*, 2020). According to Diketema *et al* (2021), older age (OR = 0.98, CI: 0.97–0.98; $p < 0.030$), lower education levels (OR = 0.59, CI: 0.45–0.79; $p < 0.001$) and lodging in crowded places (OR = 0.35, CI: 0.16–0.90; $p = 0.030$), considerably reduced the odds for better adherence. In another study, there was a positive association between adherence to the usage of PPE and having sufficient PPE materials (Diketema *et al.*, 2021). Adherence to physical distancing was positively connected with having been trained during the pandemic and the workstation being designed with marks to enable physical distancing (Wong *et al.*, 2021). A study conducted in Egypt reported that poor adherence was significantly associated with unemployment (OR = 4.96, 95% CI: 4.10–6.03), young age (OR

= 2.40, 95% CI: 1.93–2.97), and low educational level (Kasemy *et al.*, 2020). According to Kamran *et al* (2021) participants with primary level education were 70% less likely to have strong adherence to COVID-19 prevention measures than participants with a diploma (AOR = 0.32, 95% CI: 0.165-0.632) (Kamran *et al.*, 2021). Shewale *et al* (2021) reported a correlation between poverty and low level of education as determinants of adherence to NPIs . In the study, the authors reported that 73% of the participants who had low economic status had low level of education and were associated with not following protective measures for COVID-19 prevention (AOR = 1.5, 95% CI: 1.01–2.3) (Shewale *et al.*, 2021). Among the studied Ugandans, participants with higher rates of adherence had at least secondary school education (72.3%), were older than 45 years (62.3%), self-employed (57.0%), female (57%), and were Anglicans (54%) (Okello *et al.*, 2020). Poor adherence was reported among residents of the conflict-affected area (Nicholas *et al.*, 2020).

2.9 Factors affecting adherence to preventive measures in HCWs

In Ethiopia, socio-demographic characteristics such as the attitudes of HCWs, their level of education, age, sex, and years of working experience were somewhat related to COVID-19 preventive practices (Kassie *et al.*, 2020). Males had higher odds (AOR=1.48, 95%CI: 1.02, 2.10) of having poor preventive practice than females. Those with less than 10 years' work experience had higher odds (AOR=2.22, 95%CI 1.23, 4.00) of having poor COVID-19 preventive practice than those with more than 10 years' experience (Kassie *et al.*, 2020). A study in Nigeria reported that clinical HCWs had higher adherence scores (average 9.0 out of 12) as opposed to nonclinical HCWs (average 6.6 out of 12). This was attributed to the need for extra precaution in clinical HCWs because of working close to patients and knowledge differences relative to nonclinical HCWs (Iheanacho *et al.*, 2021). In a study among Ugandan HCWs, adherence was considerably associated with having received training on Covid-19 preventive measures (OR=2.86, 95%CI

1.04-7.88, p=0.039), having Covid-19 NPIs guidelines in the workstation (OR=2.90, 95%CI 1.06-8.09, p=0.036), and adequate organizational support (OR=3.08, 95%CI 1.08-8.78, p=0.031). However, no statistically significant association was recognized between adherence and socio-demographic features of the participants such as age, level of education, working hours, work experience, and profession (Bright Amanya *et al.*, 2021).

Chapter 3: Methodology

3.1 Study design

The study was an observational descriptive cross-sectional study. In observational studies, the investigators do not interfere with nor manipulate the exposures but simply observe and evaluate the strength of the association between exposures and outcome variables (Thiese, 2014). A cross-sectional design was selected because it is a survey of a population at a single point in time. It involves identifying a defined population at a specific place and point in time (Checkoway, Pearce, and Kriebel, 2009). There was no prospective or retrospective follow-up in this study, data on exposure and outcome were collected simultaneously. Once the participants were selected, the researcher collected the data and assessed the associations between outcomes and exposures.

3.2 Study setting

This study was conducted at the RFMH, a public not-for-profit faith-based regional referral hospital in the Manzini region in Eswatini. Manzini, the capital city of the Manzini Region, is in the center-west of Eswatini. It has a population of 355,945 (31% of Eswatini) (WHO, 2019). It borders the other three regions: Lubombo in the east, Hhohho in the north, and Shiselweni in the south. Manzini region is 40% rural, and the main economic activity is farming (World Food Program, 2018). Raleigh Fitkin Memorial Hospital, located almost 2km from Manzini city centre, has a bed capacity of 650, is the referral hospital for the Manzini region, and additionally functions as a teaching hospital for the Southern Africa Nazarene College of Nursing (SANU) and other tertiary medical training institutes (CDC, 2019). Considering that Manzini city and the surrounding areas are the most populated in Eswatini, the role the hospital has in providing healthcare services is vital (UNAIDS, 2017). A token user fee (SZL 20) is paid for outpatient medical services, and the hospital attends to about 500 outpatients daily. In addition, patients have access to HIV/AIDS mitigation programs such as Anti-Retroviral Therapy, Voluntary HIV Counselling and Testing, as well as Prevention of Mother to Child Transmission. In 2020, the hospital had 66 doctors, 94 nurses, and 90 allied health workers (CDC, 2020a).

3.3 Study population and sampling frame

The population of the study was drawn from HCWs in non-specialized COVID-19 units at RFMH in Manzini, Eswatini. The sampling frame for the study was drawn from the human resources list of employees at RFM Hospital with a total of 276 registered HCWs. Of these, 26 (14 nurses, 7 doctors, and 5 allied healthcare workers) were working in COVID-19 specialized units, and 250 HCWs (94 nurses, 66 doctors, and 90 allied HCWs were assigned to non-specialized COVID-19 units. All the 26 HCWs working in COVID-19 specialised units were excluded from the study.

3.4.1 Sample size and sampling

The sample size was calculated using a single population proportion method, making an allowance of the following assumptions: 95% confidence interval, 5% margin of error, and 12% proportion; with estimates obtained from a study in a similar setting in Ethiopia (Etafa *et al.*, 2021). A 10% nonresponse rate was used to yield a final sample size of 178 HCWs. Simple random proportionate to size sampling where a finite population of participants is divided into appropriate subpopulations with similar attributes or characteristics such as profession, location, etc was used (Shorten and Moorley, 2014). The population in this study was divided into three subpopulations of doctors, nurses, and allied HCWs then a simple random sampling procedure was used on each subpopulation to select HCWs from each stratum. Simple random sampling is a sampling method where a study sample is selected from a larger population (Martínez-Mesa *et al.*, 2016). Each participant is selected exclusively by chance and every prospective participant has an identical chance of being selected in the study sample (Carlson and Morrison, 2009). The number of participants from each stratum of nurses, doctors, and allied HCWs was obtained as:

The number of participants per stratum = total number of HCWs in the stratum/ total number of HCWs at RFM Hospital eligible to participate X total final sample size.

This gave the proportion of 47 doctors, 67 nurses, and 64 allied HCWs to participate in the study..

3.4.2 Participant recruitment

Upon accessing the list of HCWs at RFM Hospital and their contact information, three separate excel sheets representing the 3 strata (doctors, nurses, and allied HCWs) were generated using their unique employment numbers. A simple randomization technique was employed and the Ablebits Tools tab of Excel was used to randomly select the required number of participants from each stratum (Cheusheva, 2021). The randomly selected participants were recruited through emails, text messages and WhatApp messages, where a link with the information sheet, consent form and questionnaire was sent to them. A follow up communique was sent once a week to the participants as a reminder to complete the questionnaire or decline consent. Data was reviewed after three weeks to assess the number of participants who had responded in each strata. These processes from random selection to communicating with participants were repeated on the pool of unselected participants until the required number of participants was obtained.

3.5 Data collection tool and procedure

A link with the English-language type of a structured self-administered web-based survey was used for data collection from the selected participants. The data collection tool was developed using tools from earlier published articles and CDC recommendations (Haile, Engeda, and Abdo, 2017a; CDC, 2020b; Etafa *et al.*, 2021). An email and WhatsApp with the link to the questionnaire

(Appendix 1), the consent form (Appendix 2), and the information sheet (Appendix 3) were sent to the randomly selected participants for data collection. The questionnaire implemented in collecting data consisted of three parts as shown in Appendix 1. The first part included the independent variables, i.e. professional and demographic features of the HCWs including age, marital status, sex, professional type, level of education, having an elderly or child, work experience, past attendance to pieces of training about COVID-19 prevention, whether HCWs' had their hospital management's support and reading of materials on COVID-19. The second part of the questionnaire consisted of 14 questions intended to test HCWs' adherence to COVID-19 NPIs. Variables from the second part of the questionnaire were measured on a 5-point Likert scale (1= never, 2 = rarely, 3 = sometimes, 4= often, 5= Always) giving a range of scores from 0 to 70. A score of ≥ 52.5/70 (75%) was considered good compliance while a score < 75% was deemed poor adherence. These set categories are in line with earlier published research (Haile, Engeda, and Abdo, 2017a; Zhang *et al.*, 2020; W Etafa *et al.*, 2021). The third part of the questionnaire intended to find factors affecting adherence to COVID-19 prevention, evaluated using a five Likert Scale that assigned '1' for strongly disagree and '5' for strongly agree.

3.6 Validity of the study

External validity was ensured by using a random sampling technique and a sample size that is closely representative of HCWs at RFM hospital. Using a random sampling technique has been shown to improve external validity (Chiwaridzo *et al.*, 2017). The study tool was developed using previously published journals and CDC recommendations (Haile, Engeda, and Abdo, 2017a; CDC, 2020b; W Etafa *et al.*, 2021). The internal validity in this study focused on face and content validity. Face validity focuses on merely looking at the tool to determine if it measures what it aims to measure (Konietschke, Schwab, and Pauly, 2021) while content validity aims at the contents of the tool to ascertain whether they are addressing the variable(s) under measurement (Thwaites Bee and Murdoch-Eaton, 2016). To ensure face validity in this study, the data collection tool was shared with supervisors and fellow researchers whose feedback was unanimous that the tool measured what it intended to measure.

3.7 Reliability of the study

This study used internal consistency reliability, which is the consistency of participants' responses across the items on a multiple-item measure (Jo, Park, and Song, 2019). Internal consistency reliability involves ascertaining the degree to which variables could be depended upon to secure repeated results upon repeated application of the tool (Heale and Twycross, 2015). The test-retest method which involves administering the same questionnaire, after a period of time, and comparing the results was used.

3.8 Data analyses

Completed questionnaires were transferred onto a Microsoft Excel 2020 spreadsheet for cleaning and coding. Analyses were conducted on Statistical Package for Social Sciences (SPSS) (version 27.0) and data was presented in tables and graphs. For descriptive analyses, categorical variables were summarized using percentages, proportions, and frequencies. Continuous variables were presented in terms of the mean and standard deviation for normally distributed data, or median and interquartile range if data were non-normally distributed (Larson, 2006). Univariate descriptive analysis was conducted to describe the variable distribution in the study sample. A Chi-squared test was used to determine bivariate associations between the selected socio-demographic characteristics such as gender, marital status, age, and occupation, and the dependent variable. Multivariate analysis was performed to investigate factors associated with adherence to COVID-19 NPIs. In the multivariate analysis, the dependent variable was binary (adherence vs non-adherence to non-pharmaceutical preventive measures). The association between dependent and independent variables was determined by odds ratios (OR) with 95% Confidence Intervals (CI) around the ORs and $p<0.05$ to determine statistical significance (Paradis *et al.*, 2016).

3.9 Ethics statement

Anonymity and confidentiality were assured by using pseudonyms instead of participants' names both in data collection and reporting. An information leaflet (Appendix 3) and a consent form (Appendix 2) were given to participants. Participants were allowed to withdraw from the study at any time with no repercussions. Data was kept as password encrypted files and stored on a password-protected hard drive, with the passwords known to the researcher and supervisors only. The data will be disposed of after five years using the hard drive data erasure method. The study ensured that there was a fair selection of participants through random sampling techniques. No race, ethnicity, social group, or class was targeted. Ethical clearance was granted by the University of Western Cape's Biomedical Research Committees (Reference number: BM21/10/23) (Appendix 4). Ethics clearance for academic research and data analysis was also obtained from the National Health Research Review Board (NHRRB) of the Ministry of Health in Eswatini (Reference number: EHHRRB099/2021). Permission to conduct the study at RFM hospital was granted by the hospital administrator of (Appendix 5).

Chapter 4: Results

4.1 Introduction

This chapter presents the results of the data collected in the study. It describes the socio-demographic and professional characteristics of the study sample, the levels of adherence, and the barriers to adhering to COVID-19 non-pharmaceutical preventive measures. It includes a Chi-squared test analyses to assess adherence for each variable. Additionally, univariate logistic regression analyses to identify individual associations between predictor variables and adherence and multivariate analyses of factors affecting adherence are presented.

4.2 Socio-demographic and professional characteristics of the participants

A total of 174 (97.8% response rate) HCWs participated in this study. Three of the participants, (two whose ages were unrealistic and one who did not consent) were excluded from the analysis. Out of the 171 participants included in the analysis, 63.7% (n=109) were females. The median age was 33 years (interquartile range (IQR): 21 – 39). Categorizing by profession, 38.0% (n=65) of participants were nurses, while allied HCWs and doctors constituted 36.8% (n=63) and 25.2% (n=43) respectively. A sizeable proportion of participants 63.2% (n=108) indicated that they reside in urban areas. Fifty-seven percent (56.7%; n = 97) of the participants reported using private transport to travel to work. About 81% (80.7%, n=138) of the participants reported that they received training on COVID-19 preventive measures, with 96.5% (n=165) reporting that they read information about COVID-19. Regarding COVID-19 testing frequency, most participants (66.7%; n =114) reported that they only tested for COVID-19 when they had symptoms. Just over 75% (75.4%, n=129) of the participants confirmed being fully vaccinated with the required two doses of AstraZeneca against COVID-19. Table 1 is a summary of the socio-demographic and professional findings of the participants.

Table 1: Socio-demographic and professional characteristics of HWCs at RFMH, Manzini.

Variable	Frequency; n (%)
Age Median (IQR) years	33 (29; 4)
Gender	
Female	109 (63.7)
Male	62 (36.3)
Marital status	
Married	83 (48.5)
Single	75 (43.9)
Divorced	7 (4.1)
Widowed	4 (2.3)
Co-habiting	2 (1.2)
Education	
PhD	2 (1.2)
Masters	32 (18.7)
Bachelor's Degree	119 (69.6)
Diploma	18 (10.5)
Professional qualification	
Nurse	65 (38.0)
Allied healthcare worker	63 (36.8)
Doctor	43 (25.2)
Work experience	
Over 7 years	79 (46.2)
4-7 years	44 (25.7)
0-3 years	48 (28.1)
Elderly/child at home	
Don't have any	30 (17.5)
Have a child only	71 (41.5)

Variable	**Frequency; n (%)**
Have elderly and child	57 (33.3)
Have elderly only	13 (7.6)
Mode of transport	
Walk to work	12 (7.0)
Private transport	97 (56.7)
Public transport	39 (22.8)
Both public and private transport	23 (13.5)
Residence	
Urban area	108 (63.2)
Peri-urban area	46 (26.9)
Rural area	17 (9.9)
Trained on COVID-19 preventive measures	
Yes	138 (80.7)
No	33 (19.3)
Read information on Covid-19	
Yes	165 (96.5)
No	6 (3.5)
Covid testing frequency	
Monthly	5 (2.9)
Every 2 months	8 (4.7)
Only when I have symptoms	114 (66.7)
Never	44 (25.7)
Received COVID-19 vaccine	
Yes (All required doses)	129 (75.4)
Partially (Half required doses)	11 (6.4)
No (No dose received)	31 (18.1)
Directly in contact with patients at work	
Yes	139 (81.3)
No	32 (18.7)

4.3 Compliance of HCWs at RFMH, Manzini, to COVID-19 preventive measures

Overall, compliance with different COVID-19 preventive measures was good among HWCs at RFMH. Only 5.8% (n = 10) participants reported not following the 1.5 to 2 meters' social distance rule to prevent the spread of COVID-19 (rarely [5.3%; n = 9]) and (never [0.6%; n=1]). Fifty-nine percent (n=101) participants reported that they never shake hands with colleagues when meeting them, while 19.3% (n=33) confirmed that they rarely shake hands when meeting colleagues. Regular use of hand sanitizer during the day was confirmed by 86.0% (n=147) participants (always [44.4%; n=76], often [41.5%; n=71]). Proper donning of PPE at work was confirmed by 54.4% (n=93) of the participants (always [31.0%; n=53], often [23.4%; n=40]). Table 2 is a summary of compliance with COVID-19 preventive measures by study participants.

Table 2: Compliance of HCWs at RFMH, Manzini, with COVID-19 preventive measures

Variable	**Always n (%)**	**Often n (%)**	**Sometimes n (%)**	**Rarely n (%)**	**Never n (%)**
I follow the social 1.5 – 2m distance rule	31 (18.1)	63 (36.8)	67 (39.2)	9 (5.3)	1 (0.6)
I properly follow the steps of washing/sanitizing hands	72 (42.1)	60 (35.1)	33 (19.3)	5 (2.9)	1 (0.6)
I wash my hands using soap and water regularly	72 (42.1)	79 (42.6)	14 (8.2)	6 (3.5)	0 (0)
When I cough or sneeze, I wash/disinfect my hands immediately afterwards	46 (26.9)	61 (35.7)	55 (32.2)	8 (4.7)	1 (0.6)

Variable	Always n (%)	Often n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
I use a hand sanitizer regularly during the day	76 (44.4)	71 (41.5)	21 (12.3)	3 (1.8)	0 (0)
I shake hands while meeting colleagues	2 (1.2)	4 (2.3)	31 (18.1)	33 (19.3)	101 (59.1)
I wear a face mask when going outside	112 (65.5)	15 (8.8)	39 (22.8)	3 (1.8)	2 (1.2)
I use my personal items like mobile phones, etc during duty in the hospital	50 (29.2)	63 (36.8)	38 (22.2)	12 (7.0)	8 (4.7)
I disinfect my personal items like mobile phones etc with alcohol swabs before use	34 (19.9)	41 (24.0)	56 (32.8)	33 (19.3)	7 (4.1)
I wear adequate PPE while on duty	51 (29.8)	49 (28.7)	54 (31.6)	10 (5.9)	7 (4.1)
I properly follow the process of PPE donning	53 (31.0)	40 (23.4)	47 (27.5)	24 (14.0)	7 (4.1)
I properly follow the process of PPE doffing	56 (32.8)	37 (21.6)	46 (26.9)	25 (14.6)	7 (4.1)
I touch the outer surface of the mask while wearing it	20 (11.7)	35 (20.5)	54 (31.6)	31 (18.1)	31 (18.1)

Variable	Always n (%)	Often n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
When I cough or sneeze I do so in my elbow/ I cover my mouth	84 (49.1)	52 (30.4)	28 (16.4)	6 (3.5)	1 (0.6)
When I cough or sneeze on a tissue paper, I discard it in a hazardous waste bin	88 (51.5)	54 (31.6)	19 (11.1)	6 (3.5)	4 (2.3)
I measure my body temperature at least twice a week	45 (26.3)	26 (15.2)	46 (26.9)	34 (19.9)	20 (11.7)
I avoid touching my face (eyes, nose and mouth)	44 (25.7)	63 (36.8)	40 (23.4)	20 (11.7)	4 (2.3)

4.4 Barriers/challenges encountered in the prevention of COVID-19 transmission in the workplace

Inadequate supply of appropriate PPE was largely reported by most participants 82.45% (n=141) (Strongly agree [44.4%; n=76], Agree [38.0%; n=65]) as the main challenge encountered in the prevention of COVID-19 transmission in the workplace. Other barriers identified included staff shortages which increases workload 87.7% (n=150) (Strongly agree [57.9%; n=99], Agree [29.8%; n=51]); communication gap with higher health officials 64.3% (n=110) (Strongly agree [32.2%; n=55], Agree [32.2%; n=55]); and uncooperative community to minimize overcrowding, visitors and fast-tracking of infected patients 83.6% (n=143) (Strongly agree [39.8%; n=68], Agree [43.9%; n=75]). Findings showed that HCWs seemed to have adequate knowledge on COVID-19. Over 50% (50.9%; n=87) HCWs disagreed (Strongly disagree [7.0%; n=12], Disagree [43.9%;

n=75]) that they had limited knowledge of COVID-19. Table 3 shows how participants responded on the different challenges/barriers they encountered in the prevention of COVID-19.

Table 3: Barriers to following COVID-19 preventive measures among HCWs at RFMH, Manzini.

Challenge/Barrier	Strongly agree n (%)	Agree n (%)	Unsure n (%)	Disagree n (%)	Strongly disagree n (%)
Inadequate supplies of appropriate PPE	76 (44.4)	65 (38.0)	15 (8.78)	12 (7.0)	3 (1.8)
Lack of provision of adequate ventilation in working area	17 (9.9)	60 (35.1)	28 (16.4)	32 (18.7)	34 (19.9)
Inadequate supportive medications	45 (26.3)	66 (38.6)	31 (18.1)	24 (14.0)	5 (2.9)
Poor accessibility of hand washing amenities and surface cleansing supplies	20 (11.7)	58 (33.9)	24 (14.0)	53 (31.0)	16 (9.4)
COVID-19 guidelines are either absent or unclear, impractical or not constant	17 (9.9)	38 (22.2)	33 (19.3)	72 (42.1)	11 (6.4)
Staff shortage which increases workload	99 (57.9)	51 (29.8)	9 (5.3)	8 (4.7)	4 (2.3)
Lack of updated information on Covid-19	27 (15.8)	46 (26.9)	25 (14.6)	63 (36.8)	10 (5.9)
Lack of adequate training	11 (6.4)	47 (27.5)	30 (17.5)	58 (33.9)	25 (14.6)
Lack of sufficient room/space to isolate patients	34 (19.9)	70 (40.9)	14 (8.2)	22 (12.9)	31 (18.1)
Communication gap with higher health officials	55 (32.2)	55 (32.2)	33 (19.3)	25 (14.6)	3 (1.8)

Challenge/Barrier	Strongly agree n (%)	Agree n (%)	Unsure n (%)	Disagree n (%)	Strongly disagree n (%)
Uncooperative community (to minimize overcrowding, visitors and fast-tracking infected patients)	68 (39.8)	75 (43.9)	14 (8.2)	13 (7.6)	1 (0.6)
Limited knowledge of healthcare workers on Covid-19	10 (5.9)	43 (25.2)	31 (18.1)	75 (43.9)	12 (7.0)

4.5 Overall level of adherence to each of COVID-19 NPIs by HCWs at RFMH, Manzini

Adherence to COVID-19 non-pharmaceutical preventive measures was determined using the overall score from a five-point Likert scale on adherence questions of the questionnaire. As in previous similar studies, good adherence for each participant was defined as a percentage score greater than or equal to 75, and poor adherence was defined as a percentage score less than 75 (W Etafa *et al.*, 2021). A total of 52.6% (n=90) participants had good adherence to non-pharmaceutical preventive measures. The adherence levels for the non-pharmaceutical preventive measure ranged from 44.2% to 87.1%. Lower adherence levels were recorded in participants failing to avoid the use of personal items like mobile phones (44.1%; n=76), failing to avoid touching the outer surface of the mask while wearing it (62.1%; n=106), and failing to measure body temperature at least twice a week (64.9%; n=111). Higher adherence levels were recorded on wearing face masks when going outside (87.1%; n=149), use of hand sanitizer regularly during the day (85.7%; n=147), and avoiding shaking hands (86.6%; n=148). Figure 2 is a summary of the adherence levels.

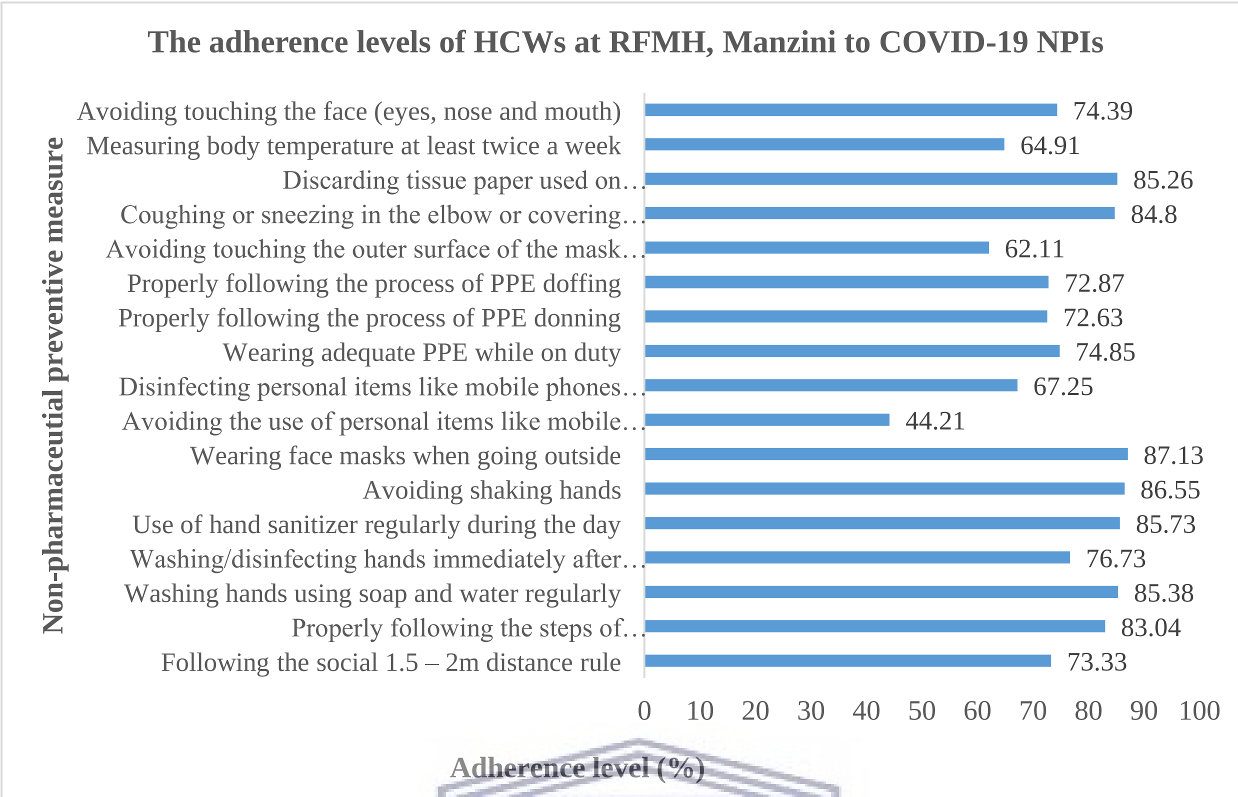

Figure 2: The adherence levels of HCWs at RFMH, Manzini to COVID-19 NPIs

4.6 Chi-square test to assess adherence for each variable

Additional analyses were performed to check the proportion of adherence for each of the variables. Stratified by profession, there was a statistically significant difference in adherence to COVID-19 preventive measures amongst the three groups of professionals who participated in the study, with allied healthcare workers being more adherent compared to nurses and doctors (Chi-square = 8.00; p = 0.02). Likewise, there was a significant difference in adherence stratified by testing frequency. Those who tested for COVID-19 monthly were more adherent to COVID-19 preventive measures compared to those who did not (Chi-square = 12.74; p = 0.01). There was also significant difference in adherence stratified by vaccination status with those not vaccinated more adherent relative to those fully or partially vaccinated. Table 4 is a summary of these findings together with the associated p-value.

Table 4: Adherence proportions for different variables among HCWs at RFMH, Manzini.

Variable	**Poor adherence (%)**	**Good adherence (%)**	**Chi-square**	**p-value**
Gender				
Male	32.3	67.7	6.99	0.11
Female	25.7	74.3		
Age group (years)				
21 -30	45.3	54.7	5.82	0.12
31-40	47.3	52.7		
41-50	40.0	60.0		
51 and above	87.5	12.5		
Profession				
Allied Healthcare workers	*33.3	*66.7	*8.00	*0.02
Doctors	*53.5	*46.5		
Nurses	*56.9	*43.1		
Work experience				
0-3years	37.5	62.5	3.47	0.18
4-7 years	56.8	43.2		
Over 7years	48.1	51.9		

Variable	Poor adherence (%)	Good adherence (%)	Chi-square	p-value
Education Qualification				
Certificate	0.00	100.0	7.65	0.17
Diploma	29.4	70.6		
Bachelor's Degree	47.1	52.9		
Masters	58.1	41.9		
PhD Student	0.0	100.0		
PhD	100.0	0.0		
Trained on COVID-19				
preventive measures	*81.8	*18.2		
No	*39.1	*60.9	*19.47	*0.00
Yes				
Read information on COVID-				
19	33.3	66.7	0.49	0.48
No	47.9	52.1		
Yes				
Mode of transport used				
Both public and private	56.5	43.5	2.23	0.53
transport	41.7	58.3		
I walk to work	43.3	56.7		
Private transport	53.9	46.2		
Public transport				

Variable	Poor adherence (%)	Good adherence (%)	Chi-square	p-value
Residence				
Peri-urban	45.7	54.4	0.44	0.80
Rural area	41.2	58.8		
Urban area	49.1	50.9		
Covid testing frequency				
Monthly	0.0	100.0	12.74	0.01
Every 2 months	25.0	75.0		
Only when I have symptoms	43.9	56.1		
Never	65.9	34.1		
Received covid vaccine				
No	41.9	58.1	5.74	0.06
Partially	81.8	18.2		
Yes, all doses	45.7	54.3		
Work in direct contact with patients				
No	37.5	62.5	1.54	0.22
Yes	49.6	50.4		

** Denotes statistical significance, p-value< 0.05*

Figure 3 is a graphical presentation of the differences in adherence stratified by profession.

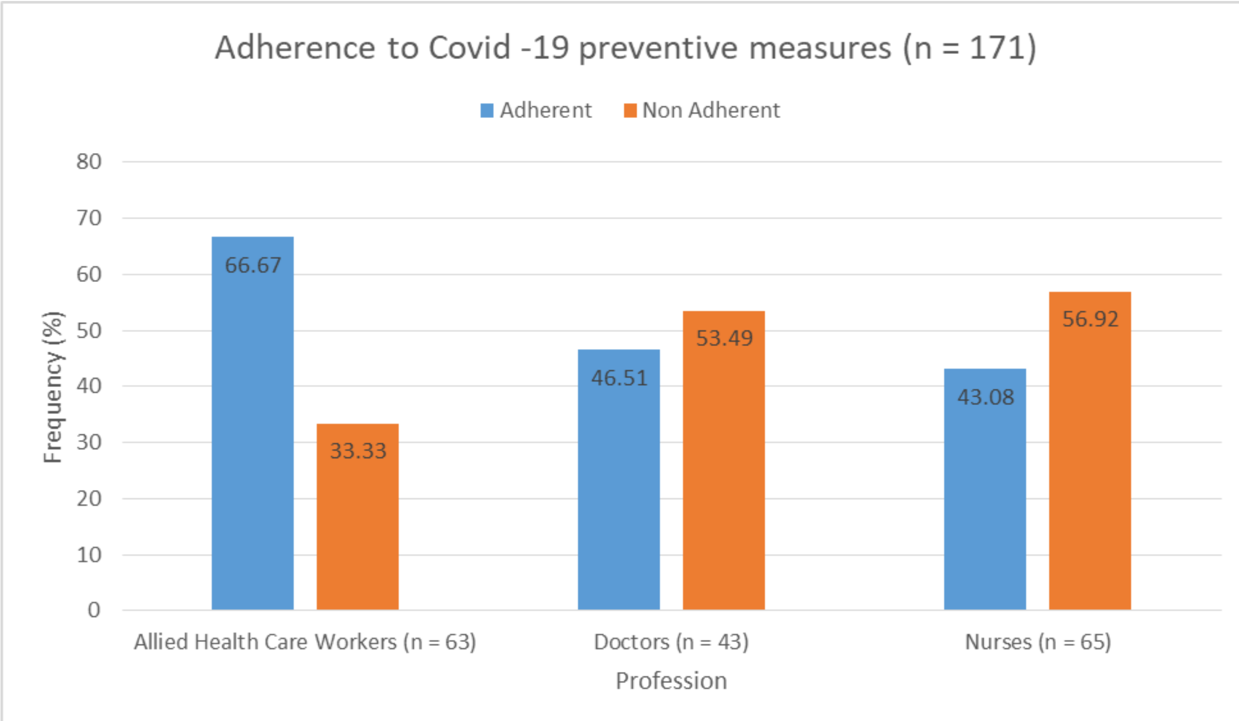

Figure 3: Adherence to COVID-19 NPIs by profession

4.7 Univariate analysis for the association between variables and adherence

A univariate logistic regression analysis was conducted to identify individual associations between predictor variables and adherence. Compared to Allied health workers, doctors (OR = 0.43; 95%CI = 0.20 - 0.96; p = 0.04) and nurses (OR = 0.38; 95%CI = 0.18-0.78; p = 0.01) were less likely to adhere to COVID-19 preventive measures respectively, and this difference was statistically significant. Healthcare workers who received training on COVID-19 preventive measures were more likely to adhere to COVID-19 preventive measures compared to those who did not receive training (OR = 7.0; 95%CI = 2.71 – 18.07; p = 0.00). Table 5 summarizes the results from the univariate logistic regression analysis.

Table 5: Factors associated with adherence to preventive measures among HCWs at RFMH, Manzini

Variable	**OR**	**95% CI**	**p-value**
Age	0.96	0.92; 1.00	0.06
Gender			
Male	1	-	-
Female	0.62	0.33; 1.17	0.14
Elderly person or child at home			
Don't have any	1.00	-	-
Have a child only	0.58	0.24; 1.38	0.22
Have an elderly person and a child	0.60	0.24; 1.47	0.26
Elderly person only	8.00	0.92; 69.84	0.06
Profession			
Allied Healthcare Worker	1.00	-	-
Doctor	**0.43*	**0.20; 0.96*	**0.04*
Nurse	**0.38*	**0.18; 0.78*	**0.01*
Work experience			
0-3 years	1.00	-	-
4-7 years	0.46	0.20; 1.05	0.07
Over 7 years	0.65	0.31; 1.35	0.24
Trained on COVID-19 preventive measures	**7.00*	**2.71; 18.07*	**0.00*
Read information about COVID-19	0.54	0.10; 3.05	0.49
Mode of transport used			
Both private and public transport	1.00	-	-
Walk to work	1.82	0.44; 7.48	0.41
Private transport	1.70	0.68; 4.26	0.26
Public transport	1.11	0.39; 3.14	0.84

Variable	OR	95% CI	p-value
Type of residence			
Peri-urban area	1.00	-	-
Rural area	1.2	0.39; 3.70	0.75
Urban area	0.87	0.44; 1.74	0.70
Covid-19 testing frequency			
Monthly	1.00	-	-
Every 2 months	9.49	0.0; -	0.99
Never	1.64	0.0; -	0.98
Only when I have symptoms of COVID-19	4.05	0.0; -	0.99
Vaccinated against Covid-19			
No	1.00	-	-
Partially (Half required doses)	**0.16*	**0.03; 0.87*	**0.03*
Yes (All required doses)	0.86	0.39; 1.89	0.70
Work requires direct contact with patients	0.61	0.28; 1.34	0.22

** Denotes statistical significance; p-value<0.05*

4.7 Multivariate analysis of factors affecting adherence

Adjusting for the profession, those who were trained on COVID-19 preventive measures were 7.4 times more likely to adhere to COVID-19 non-pharmaceutical preventive measures (AOR = 7.42; 95% CI = 2.80 - 19.64; p=0.00). Compared to allied healthcare workers, doctors were less likely to adhere to COVID-19 non-pharmaceutical preventive measures (AOR = 0.41; 95% CI = 0.18 - 0.97; p=0.04). Table 6 shows the results of the multivariate analysis.

Table 6: Multivariate analysis of factors affecting adherence to COVID-19 preventive measures by HCWs at RFMH, Manzini.

Variable	AOR	95% CI	p-value
Trained on COVID-19 preventive measures	***7.42**	***2.80; 19.64**	***0.00**
Vaccination against COVID-19			
No	1.00	-	-
Partially (Half required doses)	*0.24	*0.12; 0.56	*0.03
Yes (All required doses)	*0.37	*0.21; 0,78	*0.04
Gender			
Male	1.00	-	-
Female	0.46	0.0; 1.21	0.14
Age group (years)			
21 – 30	1.00	-	-
31 – 40	0.78	-1.23; 0.89	0.23
41 – 50	0.66	0.0; 0.98	0.27
51 and above	0.54	0.14; 0.78	0.11
Profession			
Allied healthcare worker	1.00	-	-
Doctor	***0.41**	***0.18; 0.97**	***0.04**
Nurse	***0.34**	***0.16; 0.75**	***0.01**

* *Denotes statistical significance; p-value<0.05*

Chapter 5: Discussion

Adherence to COVID-19 NPIs is important for disease control, particularly in the absence of an effective vaccine or treatment at the time of data collection. Healthcare workers' adherence to COVID-19 preventive measures is especially important considering they are at an increased risk of infection than any other profession since they spend considerable time with COVID-19 patients. Findings from this study showed that HCWs at RFM hospital were good at adhering to NPIs for the prevention of COVID-19 acquisition. This high score of self-reported adherence is congruent with an earlier self-reporting survey (Russell *et al.*, 2018). The high adherence levels could be because the study was conducted at a hospital, an institution which may make social desirability higher. Additionally, concerns that the Eswatini MoH may act on the findings, especially that it would be easy to conclude that adherence to NPIs may be less than satisfactory might have contributed. Conversely, former studies that employed observational approaches in data collection found significantly lower adherence levels (Desta *et al.*, 2018; Geberemariyam, Donka, and Wordofa, 2018). This incongruity is attributable to dissimilarities in methods used since observational studies are most likely to report lower adherence to preventive measures since participants are assessed on their practice rather than their knowledge (Bedoya *et al.*, 2017; Powell-Jackson *et al.*, 2020).

The participants in this study seemed to be more adherent to COVID-19 preventive measures compared to the participants involved in the study in the Central Gondar zone of Ethiopia (Haile, Engeda and Abdo, 2017b) and Western Ethiopia (Etafa *et al.*, 2021). However, the adherence levels were lower than those reported in the Amhara region of Ethiopia (Asemahagn, 2020b), Uganda (Olum *et al.*, 2020), and China (Bialek *et al.*, 2020), and Pakistan (Bialek *et al.*, 2020). The differences in study approaches and economic stability paralleled with other nations might be a cause for the differences in adherence observed in these settings. Studies in other nations were observational in nature (Etafa *et al.*, 2021). Moreover, these studies were conducted in countries such as China (Bialek *et al.*, 2020) with better economies than Eswatini where absence of NPIs essentials was minimized . Other reasons for these differences could be the study setting, the number of institutions included, and the phase of the COVID-19 pandemic when the studies were conducted. While the current study was performed in an urban setting, the study in Western Ethiopia (Etafa *et al.*, 2021) was performed in a rural setting. The study in Central Gondar Zone (Haile, Engeda, and Abdo, 2017b) involved more than one institution while the current study involved one institution. Other studies in China (Bialek *et al.*, 2020) and Pakistan (Bialek *et al.*, 2020) were conducted during the peak of the COVID-19 pandemic while the current study was conducted after the peak of the pandemic.

The findings of this study showed significant variation in levels of adherence to different NPIs. These findings corroborate those reported in a similar study in Southern Ethiopia (Bante *et al.*, 2021) and South Africa (Majam *et al.*, 2021), but differ from findings in Iran where there was no significant variation in levels of adherence to different NPIs (Alshammari, Alshammari, and Alshammari, 2021). Unlike in Eswatini, in South Africa the emphasis placed on other NPIs like social distancing, mask wearing and sanitising hands regularly and these were consequently perceived as the most important by the community. This shows that equivalent emphasis is not given to all COVID-19 prevention measures at RFMH as recommended by the Eswatini MoH and WHO (Padidar *et al.*, 2021). The differences in levels of adherence to different NPIs could also be due to accessibility and availability of consumables that might be needed for that particular NPI. For example, the unavailability of running water and soap within the working area might negatively impact hand washing as an NPI, while adherence to the use of PPE may be affected by the availability of PPE. Adherence to avoiding handshakes as an NPI does not depend on any consumable but choice.

Although there was no clear evidence of extremely low adherence levels in the vaccinated participants, this study showed that participants who were not vaccinated were more likely to adhere to NPIs than those partially or fully vaccinated. This is because vaccinated people have lower perceived health risks and may feel less motivated to comply with preventive measures. Empirical evidence from previous epidemics and the COVID-19 (Bish and Michie, 2010; Barber and Kim, 2021; Harper *et al.*, 2021) as well as predictions from influential models of health behaviour, such as the Risk Compensation, Health Belief and COM-B models (Michie, van Stralen and West, 2011) suggest that individuals who are less concerned about catching a virus have lower compliance.

This study also showed that profession and being trained on COVID-19 preventive measures were positively associated with adherence of HWCs to NPIs. This is in line with a study in the Amhara region of Ethiopia (Asemahagn, 2020b). Additionally, earlier studies have also reported that IPC training and availability of IPC guidelines positively impact adherence to IPC (Geberemariyam, Donka, and Wordofa, 2018; Sahiledengle *et al.*, 2018). Age, gender (Al-Hanawi *et al.*, 2020), and place of residence (Sun et al., 2020; Akalu, Ayelign, and Molla, 2020) have been reported in previous studies to be associated with adherence to NPIs. Our study mostly constituted of urban residents hence place of residence was not a factor. Consequently, the WHO and the Eswatini Ministry of Health have accentuated training of all HCWs as well as developed and provided IPC guidelines to health facilities (WHO, 2020; Evans, 2021). These exertions have most probably contributed to the high adherence levels eminent in our study. Thus, our findings further support the concept that the provision of guidelines, training, proper facilities, and adequate supplies for IPC to HCWs promote adherence (W. Gichuhi, 2015).

The differences in adherence by profession observed in this study are worrying. One of the main causes of the non-compliance to preventive measures by doctors and nurses is the perception that risks were low. The failure to recognise these risks suggests a failure to adopt the necessary precautions in their daily activities. Also, positive attitude, a prerequisite to developing new behaviors such as NPIs routines, might be lacking in doctors and nurses hence their lower levels of adherence relative to allied HCWs. It might be helpful to separately and continuously remind HCWs in their different cadres about the importance of adhering to stipulated NPIs. Since COVID-19 is an ever-evolving transmittable disease with a lot still unknown about the pathogenesis of different variants, proper training may increase HCWs' awareness and skills on this contagious infection. Such training could also be in the form of, reading resources about COVID-19 preventive measures. Consequently, hospital management ought to allow HCWs access to materials about COVID-19, for example through access to the internet in the workstation. This corresponds with the findings from Gondar Teaching University in Ethiopia, about customary precautions intended to enhance infection prevention (Haile, Engeda, and Abdo, 2017b).

Moreover, the current study acknowledged the most common obstacles reported by HCWs to adhering to COVID-19 preventive measures. Staff shortage, which increases workload, was identified as a barrier to compliance with NPIs in this study. Inadequate supply of proper PPE, which has also been reported in similar studies (Bialek *et al.*, 2020; Iversen *et al.*, 2020; Werku Etafa *et al.*, 2021), was another hurdle to implementing COVID-19 preventive measures at RFMH. The dearth of PPE may considerably impede HCWs' compliance with disease prevention and control approaches regardless of their knowledge. Insufficient supplies of PPEs in low-and middle-income countries including Eswatini are anticipated (Bialek *et al.*, 2020). This might be owing to deficient hospital budgets incapable of providing high-grade PPE in correct amounts (Tan, Goh, and Lee, 2006). The scantiness of PPE stocks might propel HCWs to use the same PPE for prolonged periods or reutilize them (Tan, Goh, and Lee, 2006).

A majority of the HCWs involved in this study also mentioned uncooperative communities as an additional impediment to COVID-19 prevention. Since the implementation of COVID-19 preventive measures involves collaboration, community participation cannot be disregarded. Unless the community is well informed about the high risks of contracting the disease in a hospital setting, they may contemplate going to visit their hospitalized folks and families as their traditional practices. This calls for resilient health systems in providing adequate and clear information about the disease to the community so as to get their cooperation in fighting the disease. Information may be shared through banners and posters at the hospital entrance, including visit restriction messages to avoid an influx of visitors.

The HCWs at RFMH reported inadequate supplies of supportive medicines such as those expedient in controlling COVID-19 deterioration. Although several medications are being considered around the world, the approved antivirals (e.g., Remdesivir) intended for COVID-19 management are in high demand (National Institute of Health, 2022). Low-income countries like Eswatini, are challenged with investing in such medicines as their requirements are enormous. Another barrier reported in this study is insufficient spaces for patient isolation is another barrier to complying with COVID-19 NPIs. This can be negatively influenced by the high volume of patients during the pandemic. Availability of adequate isolation space has been cited as the preeminent method to abate cross-contamination (Zinatsa *et al.*, 2018).

5.2 Recommendations

Long-lasting commitment and compliance are crucial to alleviate the disease propagation and reduce its impact. Since training on COVID-19 NPIs is positively associated with adherence, we recommend that all HCWs should be trained, with demonstrations, on the proper execution of various NPIs. We also recommend for the hospital administration to be intensely engaged and mandated to support HCWs by providing necessary apparatus for the prevention of COVID-19, as well as providing psychological support to HCWs. As an IPC measure, we recommend for the hospital's IPC committee to emphasize the risk posed by the use of personal mobile phones as potential source of infection and prohibit the use of personal mobile phones in work stations. Given variations in adherence among different professions, it might be advantageous to discretely and unremittingly remind HCWs in their different units of the significance of good adherence to stipulated NPIs. To lessen pressure on the available staff, we recommend the deployment of additional staff to meet the workloads as this has been shown to be an intervention that promotes adherence toCOVID-19 NPIs (Zinatsa *et al.*, 2018). We also recommend increasing the hospital's budgets toward the procurement of PPE to avoid PPE shortages and re-use. For example, the government of Spain apportioned extra funds, procured and implemented price controls, and purchased pertinent equipment suitable for COVID-19 prevention (Legido-Quigley *et al.*, 2020).

To enlighten community members on NPIs and the importance of avoiding unnecessary visits to health facilities as well as enhancing their adherence to NPIs, we recommend the provision of pertinent information and education to the community on COVID-19 NPIs.

5.3 Recommendations for future research

We recommend a qualitative study to assess the behaviours and attitudes of different HCWs on COVID-19 preventive measures. A study evaluating HCWs' perceived risk of COVID-19;

perceived effectiveness of NPI and perceived social pressure to adopt NPIs can not be underestimated. Further research covering all regions of Eswatini and including more HCWs from private, public, rural and urban locations is imperative to generalise these findings to the HWC population of Eswatini. It is also expedient to conduct a similar all inclusive study to have an overview of the adhererence levels of the general population and various professionals in Eswatini. This could be of paramount importance in tailoring population targeted interventions to circumvent the spread of contagious diseases. We recommend an observational study to eliminate reporting bias as the researcher would observe the partipants in real time and record their practices.

5.4 Limitations of the study

Although this study is among the few studies conductedin Eswatini to assess the level of adherence of HCWs to COVID-19 preventive measures, the study was not without limitations. Due to the cross-sectional nature of this study, it was challenging to establish the cause-effect relationship between the study variables. The data was collected using a self-administered online tool, and this might have resulted in a reporting bias, and could have measured the HCW's knowledge instead of the actual practice. Due to the prevailing COVID-19 problem and lockdown in Eswatini, the investigators opted for a web-based approach to safeguard the well-being of the study participants..

5.5 Conclusion

HCWs are essential frontline workers in the prevention of COVID-19 disease propagation, an infection that is certainly communicable between individuals. The results of this study showed that HCWs at RFMH in Manzini had a satisfactory level of adherence to the common COVID-19 non-pharmaceutical preventive measures, with allied healthcare workers showing to be more adherent than nurses and doctors. The multivariate analysis also showed that participants who were not vaccinated and those who received training on COVID-19 had better odds of adhering to preventive measures than the vaccinated and untrained. The levels of adherence varied considerably between the different NPI, with higher adherence levels recorded on wearing face masks when going outside, regular use of hand sanitizer during the day, and avoiding shaking hands. Lower adherence levels were recorded on participants failing to avoid the use of personal items like mobile phones, failing to avoid touching the outer surface of the mask while wearing it, and failing to measure body temperature at least twice a week. The results indicated that RFMH's HCWs had increased knowledge and cognizance of infection control strategies. Major barriers affecting adherence included inadequate supplies of PPE, staff shortages, and uncooperative community. There is need for developing more resilient health care systems and work with communities to make public health approaches (specially to major public health crises) more relevant and locally responsive. Additional studies are necessary on a larger population and scale to assess the efficacy of these measures in averting or decreasing virus transmission between HCWs and patients.

References

Adly, H.M. *et al.* (2020) 'Correlation of COVID-19 Pandemic with Healthcare System Response and Prevention Measures in Saudi Arabia', *International Journal of Environmental Research and Public Health 2020, Vol. 17, Page 6666*, 17(18), p. 6666. doi:10.3390/IJERPH17186666.

Ahmed, J. *et al.* (2020) 'Compliance and Knowledge of Healthcare Workers Regarding Hand Hygiene and Use of Disinfectants: A Study Based in Karachi', *Cureus*, 12(2). doi:10.7759/cureus.7036.

Akalu, Y., Ayelign, B. and Molla, M.D. (2020) 'Knowledge, Attitude and Practice Towards COVID-19 Among Chronic Disease Patients at Addis Zemen Hospital, Northwest Ethiopia', *Infection and drug resistance*, 13, pp. 1949–1960. doi:10.2147/IDR.S258736.

Al-Hanawi, M.K. *et al.* (2020) 'Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study', *Frontiers in Public Health*, 8, p. 217. doi:10.3389/FPUBH.2020.00217/BIBTEX.

Albeladi, F.I. *et al.* (2021) 'Level of Adherence to COVID-19 Preventive Measures Among Health Care Workers in Saudi Arabia', *Cureus*, 13(6). doi:10.7759/CUREUS.15969.

Algaissi, A.A. *et al.* (2020) 'Preparedness and response to COVID-19 in Saudi Arabia: Building on MERS experience', *Journal of Infection and Public Health*, 13(6), pp. 834–838. doi:10.1016/J.JIPH.2020.04.016.

Alshammari, A.S., Alshammari, H. and Alshammari, S. (2021) 'Factors Associated With Adherence to COVID-19 Preventive Measures Among Saudi Arabians.', *Cureus*, pp. e14623–e14623. doi:10.7759/CUREUS.14623.

Alshamrani, M.M. *et al.* (2021) 'Risk of COVID-19 morbidity and mortality among healthcare workers working in a Large Tertiary Care Hospital', *International Journal of Infectious Diseases*, 109, pp. 238–243. doi:10.1016/J.IJID.2021.07.009.

Asdaq, S.M.B. *et al.* (2021) 'Nanotechnology integration for sars-cov-2 diagnosis and treatment: An approach to preventing pandemic', *Nanomaterials*, 11(7). doi:10.3390/NANO11071841.

Asemahagn, M.A. (2020a) 'Factors determining the knowledge and prevention practice of healthcare workers towards COVID-19 in Amhara region, Ethiopia: A cross-sectional survey', *Tropical Medicine and Health*. BioMed Central Ltd, pp. 1–11. doi:10.1186/s41182-020-00254-3.

Asemahagn, M.A. (2020b) 'Factors determining the knowledge and prevention practice of healthcare workers towards COVID-19 in Amhara region, Ethiopia: A cross-sectional survey', *Tropical Medicine and Health*, 48(1), pp. 1–11. doi:10.1186/S41182-020-00254-3/TABLES/3.

Bante, A. *et al.* (2021) 'Adherence with COVID-19 Preventive Measures and Associated Factors Among Residents of Dirashe District, Southern Ethiopia', *Patient Preference and Adherence*, 15, pp. 237–249. doi:10.2147/PPA.S293647.

Bauchner, H., Fontanarosa, P.B. and Livingston, E.H. (2020) 'Conserving Supply of Personal Protective Equipment-A Call for Ideas', *JAMA*, 323(19). doi:10.1001/JAMA.2020.4770.

Bedford, J. *et al.* (2020) 'COVID-19: towards controlling of a pandemic', *The Lancet*, 395(10229), pp. 1015–1018. doi:10.1016/S0140-6736(20)30673-5.

Bedoya, G. *et al.* (2017) 'Observations of infection prevention and control practices in primary health care, Kenya', *Bulletin of the World Health Organization*, 95(7), pp. 503–516. doi:10.2471/BLT.16.179499.

Bialek, S. *et al.* (2020) 'Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020', *MMWR. Morbidity and Mortality Weekly Report*, 69(12), pp. 343–346. doi:10.15585/MMWR.MM6912E2.

Block, R. *et al.* (2020) 'African American Adherence to COVID-19 Public Health Recommendations', *HLRP: Health Literacy Research and Practice*, 4(3), p. e166. doi:10.3928/24748307-20200707-01.

Bright Amanya, S. *et al.* (2021) 'Knowledge and compliance with Covid-19infection prevention and control measures among health workers in regional referral hospital in northern Uganda: a cross-sectional online survey', *F1000Research 2021 10:136*, 10, p. 136. doi:10.12688/f1000research.51333.2.

Burki, T. (2020) 'Global shortage of personal protective equipment', *The Lancet. Infectious diseases*, 20(7), pp. 785–786. doi:10.1016/S1473-3099(20)30501-6.

Carlson, M.D.A. and Morrison, R.S. (2009) 'Study design, precision, and validity in observational studies', *Journal of Palliative Medicine*, 12(1), pp. 77–82. doi:10.1089/jpm.2008.9690.

CDC (2019) *Eswatini Country Profile*. Available at: https://www.cdc.gov/globalhivtb/where-we-work/eswatini/eswatini.html (Accessed: 14 September 2020).

CDC (2020a) *CDC Global Health - Eswatini*. Available at: https://www.cdc.gov/globalhealth/countries/eswatini/default.htm (Accessed: 14 September 2020).

CDC (2020b) *Using Personal Protective Equipment (PPE) | CDC*. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html (Accessed: 18 August 2021).

Chang, D. *et al.* (2022) 'The determinants of COVID-19 morbidity and mortality across countries', *Scientific Reports 2022 12:1*, 12(1), pp. 1–17. doi:10.1038/s41598-022-09783-9.

Cheusheva, S. (2021) *Excel random selection: how to get random sample from a dataset - Ablebits.com*. Available at: https://www.ablebits.com/office-addins-blog/2018/01/31/excel-random-selection-random-sample/ (Accessed: 18 October 2021).

Chiwaridzo, M. *et al.* (2017) 'Content validity and test-retest reliability of a low back pain questionnaire in Zimbabwean adolescents', *Archives of Physiotherapy*, 7(1), p. 3. doi:10.1186/s40945-017-0031-y.

Chou, R. *et al.* (2020) 'Epidemiology of and Risk Factors for Coronavirus Infection in Health Care Workers', *https://doi.org/10.7326/M20-1632*, 173(2), pp. 120–136. doi:10.7326/M20-1632.

Chu, D.K. *et al.* (2020) 'Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis', *The Lancet*, 395(10242), pp. 1973–1987. doi:10.1016/S0140-6736(20)31142-9.

Clark, C. *et al.* (2020) 'Predictors of COVID-19 voluntary compliance behaviors: An international investigation', *Global Transitions*, 2, pp. 76–82. doi:10.1016/J.GLT.2020.06.003.

Day, M. (2020) 'Covid-19: ibuprofen should not be used for managing symptoms, say doctors and scientists', *BMJ (Clinical research ed.)*, 368, p. m1086. doi:10.1136/BMJ.M1086.

Desta, M. *et al.* (2018) 'Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia', *BMC health services research*, 18(1). doi:10.1186/S12913-018-3277-5.

Ditekemena, J., Doumbia, S. and Ebrahim, S.H. (2020) 'COVID-19's final frontier: The central Africa region', *Travel Medicine and Infectious Disease*, 37, p. 101694. doi:10.1016/J.TMAID.2020.101694.

Drosten, C. *et al.* (2003) 'Identification of a Novel Coronavirus in Patients with Severe Acute Respiratory Syndrome', *New England Journal of Medicine*, 348(20), pp. 1967–1976. doi:10.1056/NEJMOA030747.

El-Sokkary, R.H. *et al.* (2021) 'Characteristics and predicting factors of Corona Virus Disease-2019 (COVID-19) among healthcare providers in a developing country', *PLoS ONE*, 16(1 January). doi:10.1371/journal.pone.0245672.

Elhadi, M. *et al.* (2020) 'Concerns for low-resource countries, with under-prepared intensive care units, facing the COVID-19 pandemic', *Infection, Disease and Health*, 25(4), pp. 227–232. doi:10.1016/j.idh.2020.05.008.

Etafa, W *et al.* (2021) 'Healthcare workers' compliance and its potential determinants to prevent COVID-19 in public hospitals in Western Ethiopia', *BMC infectious diseases*, 21(1). doi:10.1186/S12879-021-06149-W.

Etafa, Werku *et al.* (2021) 'Healthcare workers' compliance and its potential determinants to prevent COVID-19 in public hospitals in Western Ethiopia', *BMC Infectious Diseases*, 21(1), pp. 1–8. doi:10.1186/S12879-021-06149-W/TABLES/3.

Evans, H.C. (2021) 'Newspapers' coverage of the COVID-19 pandemic in Eswatini: from distanciated re/presentations to socio-health panics', *Humanities and Social Sciences Communications 2021 8:1*, 8(1), pp. 1–9. doi:10.1057/s41599-021-01012-4.

Fang, L., Karakiulakis, G. and Roth, M. (2020) 'Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection?', *The Lancet Respiratory Medicine*, 8(4), p. e21. doi:10.1016/S2213-2600(20)30116-8.

Felix, T. (2020) *Kenya, Eswatini mourn loss of doctors due to COVID-19*. Available at: https://www.aa.com.tr/en/africa/kenya-eswatini-mourn-loss-of-doctors-due-to-covid-19/1906010 (Accessed: 20 June 2021).

Garralda Fernandez, J. *et al.* (2021a) 'Impact of SARS-CoV-2 pandemic among health care workers in a secondary teaching hospital in Spain', *PloS one*, 16(1), p. e0245001. doi:10.1371/journal.pone.0245001.

Garralda Fernandez, J. *et al.* (2021b) 'Impact of SARS-CoV-2 pandemic among health care workers in a secondary teaching hospital in Spain', *PloS one*, 16(1), p. e0245001. doi:10.1371/journal.pone.0245001.

Geberemariyam, B.S., Donka, G.M. and Wordofa, B. (2018) 'Assessment of knowledge and practices of healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District, Southeast Ethiopia: a facility-based cross-sectional study', *Archives of public health = Archives belges de sante publique*, 76(1). doi:10.1186/S13690-018-0314-0.

de Groot, R.J. *et al.* (2013) 'Commentary: Middle East Respiratory Syndrome Coronavirus (MERS-CoV): Announcement of the Coronavirus Study Group', *Journal of Virology*, 87(14), pp. 7790–7792. doi:10.1128/JVI.01244-13.

Guo, Y.R. *et al.* (2020) 'The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak- A n update on the status', *Military Medical Research*. BioMed Central Ltd. doi:10.1186/s40779-020-00240-0.

Haile, T.G., Engeda, E.H. and Abdo, A.A. (2017a) 'Compliance with Standard Precautions and Associated Factors among Healthcare Workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia', *Journal of Environmental and Public Health*, 2017. doi:10.1155/2017/2050635.

Haile, T.G., Engeda, E.H. and Abdo, A.A. (2017b) 'Compliance with Standard Precautions and Associated Factors among Healthcare Workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia', *Journal of Environmental and Public Health*, 2017. doi:10.1155/2017/2050635.

Heale, R. and Twycross, A. (2015) 'Validity and reliability in quantitative studies', *Evidence-Based Nursing*, 18(3), pp. 66–67. doi:10.1136/EB-2015-102129.

Houghton, C. *et al.* (2020) 'Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: A rapid qualitative evidence synthesis', *Cochrane Database of Systematic Reviews*. John Wiley and Sons Ltd, pp. 1–55. doi:10.1002/14651858.CD013582.

Iheanacho, T. *et al.* (2021) 'Assessing knowledge, attitude, practice and training related to COVID-19: A cross-sectional survey of frontline healthcare workers in Nigeria', *BMJ Open*, 11(9). doi:10.1136/bmjopen-2021-050138.

Iversen, K. *et al.* (2020) 'Risk of COVID-19 in health-care workers in Denmark: an observational cohort study', *The Lancet Infectious Diseases*, 20(12), pp. 1401–1408. doi:10.1016/S1473-3099(20)30589-2/ATTACHMENT/37B7607F-984F-42F7-B059-568368C0ED37/MMC1.PDF.

Jo, H.K., Park, S.K. and Song, E. (2019) 'Reliability and validation of the Korean Compassionate Communication Scale', *Frontiers of Nursing*, 6(3), pp. 175–182. doi:10.2478/FON-2019-0026.

Kasemy, Z.A. *et al.* (2020) 'Knowledge, Attitude and Practice toward COVID-19 among Egyptians', *Journal of epidemiology and global health*, 10(4), pp. 378–385. doi:10.2991/JEGH.K.200909.001.

Kassie, B.A. *et al.* (2020a) 'Poor COVID-19 Preventive Practice among Healthcare Workers in Northwest Ethiopia, 2020', *Advances in Public Health*, 2020. doi:10.1155/2020/7526037.

Kassie, B.A. *et al.* (2020b) 'Poor COVID-19 Preventive Practice among Healthcare Workers in Northwest Ethiopia, 2020', *Advances in Public Health*, 2020. doi:10.1155/2020/7526037.

Kim, R. *et al.* (2020) 'Comparison of COVID-19 infections among healthcare workers and non-healthcare workers', *PLoS ONE*, 15(12 December). doi:10.1371/journal.pone.0241956.

Kobia, F. and Gitaka, J. (2020) 'COVID-19: Are Africa's diagnostic challenges blunting response effectiveness?', *AAS Open Research*, 3, p. 4. doi:10.12688/AASOPENRES.13061.1.

Konietschke, F., Schwab, K. and Pauly, M. (2021) 'Small sample sizes: A big data problem in high-dimensional data analysis', *Statistical Methods in Medical Research*, 30(3), pp. 687–701. doi:10.1177/0962280220970228.

Lai, S. *et al.* (2020) 'Effect of non-pharmaceutical interventions to contain COVID-19 in China', *Nature*, 585(7825), pp. 410–413. doi:10.1038/s41586-020-2293-x.

Larson, M.G. (2006) 'Descriptive statistics and graphical displays', *Circulation*, 114(1), pp. 76–81. doi:10.1161/CIRCULATIONAHA.105.584474.

Legido-Quigley, H. *et al.* (2020) 'The resilience of the Spanish health system against the COVID-19 pandemic', *The Lancet Public Health*, 5(5), pp. e251–e252. doi:10.1016/S2468-2667(20)30060-8.

Martínez-Mesa, J. *et al.* (2016) 'Sampling: How to select participants in my research study?', *Anais Brasileiros de Dermatologia*, 91(3), pp. 326–330. doi:10.1590/abd1806-4841.20165254.

Matakanye, H., Ramathuba, D.U. and Tugli, A.K. (2019) 'Caring for Tuberculosis Patients: Understanding the Plight of Nurses at a Regional Hospital in Limpopo Province, South Africa', *International Journal of Environmental Research and Public Health 2019, Vol. 16, Page 4977*, 16(24), p. 4977. doi:10.3390/IJERPH16244977.

Mwendwa, P. *et al.* (2021) 'COVID-19 and vaccines in Africa: a descriptive and thematic analysis of Twitter content', *HRB Open Research 2021 4:43*, 4, p. 43. doi:10.12688/hrbopenres.13255.1.

National Institute of Health (2022) *COVID-19 Treatment Guidelines*. Available at:

https://www.covid19treatmentguidelines.nih.gov/ (Accessed: 9 January 2022).

Nguyen, L.H. *et al.* (2020) 'Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study', *The Lancet Public Health*, 5(9), pp. e475–e483. doi:10.1016/S2468-2667(20)30164-X.

Nhari, L.G. *et al.* (2020) 'Implementing effective TB prevention and treatment programmes in the COVID-19 era in Zimbabwe. A call for innovative differentiated service delivery models', *Public Health in Practice*, 1, p. 100058. doi:10.1016/j.puhip.2020.100058.

Nicholas, T. *et al.* (2020) 'COVID-19 knowledge, attitudes and practices in a conflict affected area of the South West Region of Cameroon', *The Pan African medical journal*, 35(Suppl 2), p. 34. doi:10.11604/PAMJ.SUPP.2020.35.2.22963.

Okello, G. *et al.* (2020) 'Findings of a Cross-Sectional Survey on Knowledge, Attitudes, and Practices about COVID-19 in Uganda: Implications for Public Health Prevention and Control Measures', *BioMed Research International*, 2020. doi:10.1155/2020/5917378.

Olum, R. *et al.* (2020) 'Coronavirus Disease-2019: Knowledge, Attitude, and Practices of Health Care Workers at Makerere University Teaching Hospitals, Uganda', *Frontiers in Public Health*, 8, p. 181. doi:10.3389/FPUBH.2020.00181/BIBTEX.

Otter, J.A., Yezli, S. and French, G.L. (2011) 'The role played by contaminated surfaces in the transmission of nosocomial pathogens', *Infection control and hospital epidemiology*, 32(7), pp. 687–699. doi:10.1086/660363.

Padidar, S. *et al.* (2021) 'Assessment of early COVID-19 compliance to and challenges with public health and social prevention measures in the Kingdom of Eswatini, using an online survey', *PLOS ONE*, 16(6), p. e0253954. doi:10.1371/JOURNAL.PONE.0253954.

Pandey, A. *et al.* (2021) 'Determinants of COVID-19 pandemic in India: an exploratory study of Indian states and districts', *Journal of Social and Economic Development* [Preprint]. doi:10.1007/S40847-021-00154-0.

Paradis, E. *et al.* (2016) 'Design: Selection of Data Collection Methods', *Journal of graduate medical education*, 8(2), pp. 263–264. doi:10.4300/JGME-D-16-00098.1.

Powell-Jackson, T. *et al.* (2020) 'Infection prevention and control compliance in Tanzanian outpatient facilities: a cross-sectional study with implications for the control of COVID-19', *The Lancet. Global health*, 8(6), pp. e780–e789. doi:10.1016/S2214-109X(20)30222-9.

Prem, K. *et al.* (2020) 'The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: a modelling study', *The Lancet Public Health*, 5(5), pp. e261–e270. doi:10.1016/S2468-2667(20)30073-6.

Russell, D. *et al.* (2018) 'Factors for compliance with infection control practices in home healthcare: findings from a survey of nurses' knowledge and attitudes toward infection control', *American journal of infection control*, 46(11), pp. 1211–1217. doi:10.1016/J.AJIC.2018.05.005.

Sahiledengle, B. *et al.* (2018) 'Infection Prevention Practices and Associated Factors among Healthcare Workers in Governmental Healthcare Facilities in Addis Ababa', *Ethiopian journal of health sciences*, 28(2), pp. 177–186. doi:10.4314/EJHS.V28I2.9.

Salazar de Pablo, G. *et al.* (2020) 'Impact of coronavirus syndromes on physical and mental health of health care workers: Systematic review and meta-analysis', *Journal of Affective Disorders*, 275, pp. 48–57. doi:10.1016/J.JAD.2020.06.022.

Shah, A.S.V. *et al.* (2020) 'Risk of hospital admission with coronavirus disease 2019 in healthcare workers and their households: nationwide linkage cohort study', *BMJ*, 371. doi:10.1136/BMJ.M3582.

Shaukat, N., Ali, D.M. and Razzak, J. (2020) 'Physical and mental health impacts of COVID-19 on healthcare workers: A scoping review', *International Journal of Emergency Medicine*, 13(1), pp. 1–8. doi:10.1186/S12245-020-00299-5/TABLES/2.

Shorten, A. and Moorley, C. (2014) 'Selecting the sample', *Evidence-Based Nursing*. BMJ Publishing Group, pp. 32–33. doi:10.1136/eb-2014-101747.

Siewe Fodjo, J.N. *et al.* (2020) 'Mass masking as a way to contain COVID-19 and exit lockdown in low- and middle-income countries', *Journal of Infection*. W.B. Saunders Ltd, pp. e1–e5. doi:10.1016/j.jinf.2020.07.015.

Smith, Louise E *et al.* (2020) 'Adherence to protective measures among health care workers in the UK; a cross-sectional study', *medRxiv*, p. 2020.07.24.20161422. doi:10.1101/2020.07.24.20161422.

Smith, Louise E. *et al.* (2020) 'Adherence to protective measures among health care workers in the UK; a cross-sectional study', *medRxiv*, p. 2020.07.24.20161422. doi:10.1101/2020.07.24.20161422.

Souadka, A. *et al.* (2020) 'COVID-19 and Healthcare worker's families: behind the scenes of frontline response', *eClinicalMedicine*, 23. doi:10.1016/J.ECLINM.2020.100373.

Sun, Z. *et al.* (2020) 'Influencing Factors of Understanding COVID-19 Risks and Coping Behaviors among the Elderly Population', *International Journal of Environmental Research and Public Health 2020, Vol. 17, Page 5889*, 17(16), p. 5889. doi:10.3390/IJERPH17165889.

Tan, L.F. (2020) 'Preventing the transmission of COVID-19 amongst healthcare workers', *Journal of Hospital Infection*, 105(2), pp. 364–365. doi:10.1016/j.jhin.2020.04.008.

Tan, N.C., Goh, L.G. and Lee, S.S. (2006) 'Family physicians' experiences, behaviour, and use of personal protection equipment during the SARS outbreak in Singapore: Do they fit the Becker Health Belief Model?', *Asia-Pacific Journal of Public Health*, 18(3), pp. 49–56. doi:10.1177/10105395060180030901.

The Lancet (2020) 'COVID-19: too little, too late?', *The Lancet*. Lancet Publishing Group, p. 755. doi:10.1016/S0140-6736(20)30522-5.

The Observer (2021) *Swaziland: Total 86 Health Workers Die From Coronavirus At Single Swaziland Hospital - allAfrica.com*. Available at: https://allafrica.com/stories/202105100833.html (Accessed: 20 June 2021).

Thiese, M.S. (2014) 'Observational and interventional study design types; an overview', *Biochemia Medica*, 24(2), pp. 199–210. doi:10.11613/BM.2014.022.

Thwaites Bee, D. and Murdoch-Eaton, D. (2016) 'Questionnaire design: The good, the bad and the pitfalls', *Archives of Disease in Childhood: Education and Practice Edition*, 101(4), pp. 210–212. doi:10.1136/archdischild-2015-309450.

Times of Swaziland (2021) *Times Of Swaziland*. Available at: http://www.times.co.sz/news/131797-10-healthcare-workers-die-in-2-months.html (Accessed: 20 June 2021).

Turk, E. *et al.* (2021) 'Adherence to COVID-19 mitigation measures: The role of sociodemographic and personality factors', *Current Psychology 2021*, pp. 1–17. doi:10.1007/S12144-021-02051-5.

UNAIDS (2017) *Eswatini | UNAIDS*. Available at: http://www.unaids.org/en/regionscountries/countries/swaziland (Accessed: 2 May 2019).

Verbeek, J.H. *et al.* (2020) 'Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff', *Cochrane Database of Systematic Reviews*. John Wiley and Sons Ltd. doi:10.1002/14651858.CD011621.pub4.

Verity, R. *et al.* (2020) 'Estimates of the severity of coronavirus disease 2019: a model-based analysis', *The Lancet Infectious Diseases*, 20(6), pp. 669–677. doi:10.1016/S1473-3099(20)30243-7/ATTACHMENT/E32585C1-0F24-46F4-855E-FC2C52BBAFD7/MMC1.PDF.

W. Gichuhi, A. (2015) 'Health Care Workers Adherence to Infection Prevention Practices and Control Measures: A Case of a Level Four District Hospital in Kenya', *American Journal of Nursing Science*, 4(2), p. 39. doi:10.11648/J.AJNS.20150402.13.

Wang, J., Lee, Y.F. and Zhou, M. (2020) 'What is the best timing for health care workers infected with COVID-19 to return to work?', *American Journal of Infection Control*, 48(9), pp. 1128–1129. doi:10.1016/j.ajic.2020.06.217.

Wei, J. Te *et al.* (2020) 'Epidemiology of and Risk Factors for COVID-19 Infection among Health Care Workers: A Multi-Centre Comparative Study', *International Journal of Environmental Research and Public Health 2020, Vol. 17, Page 7149*, 17(19), p. 7149. doi:10.3390/IJERPH17197149.

WHO (2019) 'WHO | Eswatini', *WHO* [Preprint]. Available at: https://www.who.int/countries/swz/en/ (Accessed: 24 March 2019).

WHO (2020) *Infection prevention and control during health care when COVID-19 is suspected:*

interim guidance, 19 March 2020. Available at: https://apps.who.int/iris/handle/10665/331495 (Accessed: 20 April 2022).

WHO (2021) *Eswatini: WHO Coronavirus Disease (COVID-19) Dashboard With Vaccination Data | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data*. Available at: https://covid19.who.int/region/afro/country/sz (Accessed: 9 May 2021).

World Food Program (2018) *WFP Eswatini Country Brief, May 2018 - Eswatini | ReliefWeb*. Available at: https://reliefweb.int/report/swaziland/wfp-eswatini-country-brief-may-2018 (Accessed: 15 May 2019).

Worldometer (2022) *COVID Live - Coronavirus Statistics - Worldometer*. Available at: https://www.worldometers.info/coronavirus/#main_table (Accessed: 6 March 2022).

Xiang, Y.T. *et al.* (2020) 'Tribute to health workers in China: A group of respectable population during the outbreak of the COVID-19', *International journal of biological sciences*, 16(10), pp. 1739–1740. doi:10.7150/IJBS.45135.

Zhang, M. *et al.* (2020) 'Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China', *Journal of Hospital Infection*, 105(2), pp. 183–187. doi:10.1016/J.JHIN.2020.04.012.

Zheng, L. *et al.* (2020) 'Analysis of the Infection Status of Healthcare Workers in Wuhan During the COVID-19 Outbreak: A Cross-sectional Study', *Clinical Infectious Diseases*, 71(16), pp. 2109–2113. doi:10.1093/CID/CIAA588.

Zhou, F. *et al.* (2020) 'Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study', *The Lancet*, 395(10229), pp. 1054–1062. doi:10.1016/S0140-6736(20)30566-3/ATTACHMENT/E61DC4CE-2C32-4FA9-85D7-95911E7D3B94/MMC1.PDF.

Zinatsa, F. *et al.* (2018) 'Voices from the frontline: Barriers and strategies to improve tuberculosis infection control in primary health care facilities in South Africa', *BMC Health Services Research*, 18(1), pp. 1–12. doi:10.1186/S12913-018-3083-0/TABLES/1.

Appendices

Appendix 1: Questionnaire

Questionnaire prepared to assess "Factors associated with adherence to COVID-19 preventive measures among healthcare workers in Eswatini".

Section I: It focuses on demographic and professional characteristics of healthcare workers. Please write the number or your appropriate choice in the space provided.		
Variables	**Options**	**Response**
1. What is your sex?	**1.** Male **2.** Female **3.** I prefer not to say	
2. How old are you?	I am years old	
3. What is your marital status	**1.** Married **2.** Single **3.** Widowed/Widower **4.** Divorced **5.** Co-habiting	
4. Do you have an old person/child at home?	**1.** I have a child **2.** I have an old person **3.** I have both **4.** I don't have any	
5. How many years of experience do you have?	1. 1-3 2. 4-7 3. >7	
6. What is your professional occupation?	**1.** Doctor **2.** Nurse **3.** Allied Healthcare worker	
7. Which is your professional qualificationlevel?	**1.** PhD **2.** Masters **3.** Bachelor's degree **4.** Diploma	
8. Have you ever received training on COVID19 preventive measures?	**1.** Yes **2.** No	
9. Did you read informational materials (e.g., articles, brochures, guidelines) on COVID-19?	**1.** Yes **2.** No	
10. What mode of transport do you use to go to work?	**1.** Private **2.** Public **3.** I walk **4.** Both private and public	
11. Have you been vaccinated against COVID-19?	1. Yes (required doses received) 2.Partially (half required doses)	

	3. No (No dose received)	
<u>Section II: Answer the following questions by marking (Y) in corresponding column according to frequency of your performance/practice/ to assess compliance level of HWCs at RFMH, Manzini. The options for responses are SA= Strongly agree, A= Agree, US= Unsure, DA=Disagree & SDA= strongly disagree.</u>		
Compliance Activities	**SA, A, US, DA, SDA**	**Response**
1. I follow the social 1.5-2m meters distance rule		
2. I know and properly follow the steps of washing/sanitizing hands		
3. I shake hands while meeting colleagues		
4. I wear a face mask when going outside		
5. I use my personal items like mobile phones, etc during duty in the hospital		
6. I follow the steps of donning and doffing PPE properly		
7. I wear adequate PPE during duty		
8. I touch the outer surface of the mask while wearing it		
9. When I cough or sneeze, I do so in my elbow and/or I cover my mouth with a tissue paper		
10. When I cough or sneeze, I usually wash/disinfect my hands immediately afterwards		
11. I measure my body temperature at least twice a week		
12. I wash my hands using soap and water regularly during the day		
13. I use a hand sanitizer regularly during the day		
14. I avoid touching my face (eyes, nose and mouth)		
<u>Section III: Following COVID-19 preventive measures, please choose by ticking (Y) the challenge/barrier to prevent COVVID-19 in your hospital in the column from Strongly agree (SA) to strongly disagree (SDA) as shown below. NB: SA= Strongly agree, A= Agree, US= Unsure, DA=Disagree & SDA= strongly disagree</u>		
Challenges/Barriers	**SA, A, US, DA, SDA**	**Response**
1. Inadequate supplies of appropriate PPE (including required standard)		
2. Lack of provision of adequate ventilation		
3. Inadequate supportive medications		
4. Poor access to hand washing facilities and surface decontamination supplies		
5. Guidelines (absence, unclear, impractical or not constant)		
6. Staff shortage which increases workload		
7. Lack of updated information		

9. Lack of adequate training		
10. Lack of sufficient room/space to isolate patients		
11. Communication gap with higher health officials (like Ministry of Health or Regional Health officials)		
12. Uncooperative community (to minimize overcrowding, visitors and fast-tracking infected patients)		

Appendix 2: Consent form

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2809, Fax: 27 21-959 2872
E-mail: soph-comm@uwc.ac.za

CONSENT FORM

Title of Research Project: **Factors associated with adherence to COVID-19 preventive measures among health-care workers in Eswatini**

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve, and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

Participant's name: ……………………….
Participant's signature: ……………………………….
Date: ……………………….

Appendix 3: Information sheet

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21 959 2809 Fax: 27 21 959 2872
E-mail: soph-comm@uwc.ac.za

INFORMATION SHEET

Project Title: Factors associated with adherence to COVID-19 preventive measures among health-care workers in Eswatini

What is this study about?
This is a research project being conducted by **Knowledge Denhere** at the University of the Western Cape. We are inviting you to participate in this research project because you are a healthcare worker at Raleigh Fitkin Memorial Hospital in Manzini, Eswatini. The purpose of this research project is to find factors affecting adherence to COVID-19 preventive measures to contribute towards development of effective strategies to improve adherence and reduce transmission of COVID-19.

What will I be asked to do if I agree to participate?
You will be asked to complete and sign a consent form. After this you will be asked to complete and submit the attached web-based questionnaire divided into 3 sections consisting of questions on your demographic and professional details (such as sex, age, marital status, having child or old family, profession, level of education, work experience, past attendance of training about infection prevention/COVID-19, reading of materials on COVID-19), your adherence to preventive measures and factors you think are affecting your adherence to these measures. Completing the questionnaire is expected to last for at least 20 minutes. No further information nor follow up interview will be required of you after completing the questionnaire.

Would my participation in this study be kept confidential?
The researchers undertake to protect your identity and the nature of your contribution. To ensure your anonymity, this survey is anonymous and will not contain information that may personally identify you. To ensure your confidentiality, the completed questionnaires will be kept in a password protected computer only accessible to the researcher. If the researcher writes a report or article about this research project, your identity will be protected.

What are the risks of this research?
There may be some risks from participating in this research study. All human interactions and talking about self or others carry some amount of risks. We will nevertheless minimise such risks and act promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

What are the benefits of this research?

The benefits to you include change in behaviours, practices and attitudes towards COVID-19 so as to protect yourself, patients, colleagues and the community from this pandemic. Other healthcare workers and general people who may come across the findings may also benefit similarly. The findings of this study will be used to make recommendations to increase adherence to preventive measures and hence improve health outcomes amongst HCWs, patients and the general population by reducing COVID-19 morbidity and mortality rates.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

What if I have questions?

This research is being conducted by **Knowledge Denhere and School of Public health** at the University of the Western Cape. If you have any questions about the research study itself, please contact **Knowledge Denhere** at 3911203@myuwc.ca.za, or WhatsApp on +353899796266 or +26878278390.

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Prof U Lehmann
Head of Department: School of Public Health
University of the Western Cape
Private Bag X17
Bellville 7535
ulehmann@uwc.ac.za

Prof Anthea Rhoda
Dean: Faculty of Community and Health Sciences
University of the Western Cape
Private Bag X17
Bellville 7535
chs-deansoffice@uwc.ac.za

This research has been approved by the University of the Western Cape's Biomedical Research Ethics Committee.

Humanities and Social Sciences Research Ethics Committee
University of the Western Cape
Private Bag X17
Bellville
7535
Tel: 021 959 4111

E-mail: research-ethics@uwc.ac.za

REFERENCE NUMBER: ***BM21/10/23***

Appendix 4: University of the Western Cape Ethical clearance

UNIVERSITY *of the* WESTERN CAPE

60 YEARS *of hope, action & knowledge*

29 November 2021

Mr K Denhere
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number:	BM21/10/23
Project Title:	Factors associated with adherence to COVID-19 preventive measures among health-care workers in Eswatini
Approval Period:	**29 November 2021 – 29 November 2024**

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project and the requested amendment to the project.

Any further amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

For permission to conduct research using student and/or staff data or to distribute research surveys/questionnaires please apply via:
https://sites.google.com/uwc.ac.za/permissionresearch/home

The permission letter must then be submitted to BMREC for record keeping purposes.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

NHREC Registration Number: BMREC-130416-050

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

Appendix 5: Permission to conduct study at RFM Hospital

Eswatini Nazarene Health Institution (ENHI)
Raleigh Fitkin Memorial (RFM) Hospital
& the Community Health Clinics

17 November 2021

Knowledge Denhere
University of the Western Cape
Private Bag X 17,
Bellville 7535
South Africa

Dear Sir

RE: AUTHORIZATION TO DO RESEARCH IN THE HOSPITAL

Your request on the fore mentioned endeavors has been duly considered and permission granted on the following conditions please:

a). That confidentiality is strictly observed

b). That the hospital receives a copy of the report on the proposed research.

Yours Sincerely

Leonard S. Dlamini (Mr.)
HOSPITAL ADMINISTRATOR

CC: Matron 1
SMO

Appendix 6: Permission to conduct study in Eswatini

ESWATINI
HEALTH AND HUMAN
RESEARCH REVIEW BOARD
MBANDZENI HOUSE, 3RD FLOOR, CHURCH STREET
P.O. BOX 5, MBABANE, ESWATINI

ONE YEAR RESEARCH PROTOCOL APPROVAL CERTIFICATE

BOARD REGISTRATION NUMBER	**FWA 00026661/IRB 00011253**				
PROTOCOL REFERENCE NUMBER	EHHRRB099/2021				
Type of review	Expedited	X		Full Board	
Name of Organization	**Master' Student**				
Title of study	Factors associated with adherence to COVID-19 preventive measures among health-care workers in Eswatini.				
Protocol version	1.0				
Nature of application	New X	Amendment	Renewal	Extension	CT updates
List of study sites	Raleigh Fitkin Memorial Hospital				
Name of Principal Investigator	**Mr. Knowledge Denhere**				
Names of Co- Investigators	Dr. Hanani Tabana, Dr. Nondumiso Ncube				
Names of steering committee members in the case of clinical trials	N/A				
Names of Data and Safety Committee members in the case of clinical trials	N/A				
Level of risk (Tick appropriate box)	Minimal X		More than minimal		High
Initial study Approval information	Approved X; Approval date 17/03/2022		Study completion date	31/12/2022	Certificate expiry Date 17/03/2023
Study renewal approval information	**Renewal date**				**End date**
Study amendment approval information	**Amendment date**				
Study extension approval information	**Extension date**				**End date**
Signature of Chairperson					
Signing date	**17/03/2022**				
Secretariat Contact Details	Name of contact officers		Babazile Shongwe		
	Email address		ehhrrbeswatini@gmail.com/es@ehhrrb.org.sz		
	Telephone no.		+268 2404 7751		

ESWATINI HEALTH & HUMAN RESEARCH REVIEW BOARD
17 MAR 2022
P.O BOX 5, MBABANE H100
EHHRRB

APPROVAL CONDITIONS

Ref.	Conditions	Indication of conditions (tick appropriate box)				
1	Implementation of approved version of protocol					
2	Provide a specific insurance cover certificate in respect of this particular study within 14 days of receiving this Ethics Clearance certificate					
3	Update information on adverse events both on the addendum and the informed consent form to include measures for addressing life threatening adverse events that occur at home.					
4	Reporting of adverse events within 5 days of occurrence					
5	Submission of progress reporting for multi-year studies	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
6	Submission of end of project report (Hard copy)	✓				
7	Submission of end of project report (Soft copy)	✓				
	Submission of data sets	✓				

List of reviewed documents

Ref.	Documents	Reviewed documents (tick appropriate box)
1	Completed application form	✓
2	Cover letters	✓
3	Evidence of administrative permission to conduct the research by involved institutions/sites (where applicable)	
4	Detailed current resume or curriculum vitae of Principal Investigator/s including Principal investigators declaration	✓
5	Summary resume or biography for other investigator(s)	✓
6	Evidence of approval/rejection by other Ethics Committees, including comments and requested alterations to the protocol, where appropriate.	✓
7	Research protocol (see outline in Annex 1)	✓
8	Questionnaires and interview guides (with back-translated versions where applicable)	✓
9	Case report forms (CRFs), abstraction forms and other data collection tools	
10	Participant/subjects Information Statement(s) (where applicable)	✓
11	Informed consent form(s) including photographic and electronic media consent statements.	✓
12	Advertisements relevant to the study (where applicable)	
13	Source of funding and detailed budget breakdown including material and incentives to participants if applicable	✓
14	Notification form for adverse effects/events.	
15	Proof of payment	✓
16	Proof of insurance cover for research subjects in clinical trials or where applicable	
17	Any other special requirements should be stated, if applicable	N/A