EVALUATING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT HEALTHCARE -ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS

A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR DOCTOR OF PHILOSOPHY IN NURSING SCIENCE

In the

FACULTY OF HEALTH SCIENCES

DEPARTMENT OF NURSING SCIENCES

At the

UNIVERSITY OF PRETORIA

Student name: Abena Serwaa Ofosu

Student number: U21834793

Supervisor: Prof. N.C. Van Wyk

Co-Supervisor: Dr M. Rasweswe

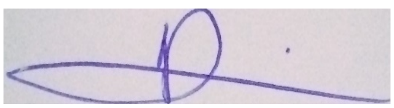
November 2023

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DECLARATION PAGE

I, Abena Serwaa Ofosu, hereby declare that this thesis, EVALUATING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS is my original work. It has not been submitted at any other institution before for any degree or examination. All the sources used and quoted were acknowledged by means of complete reference in the text and bibliography.

DATE



29th November,2023

………………………………..

DEDICATION

This is for my beloved MOTHER and Grandmother:

Ms Christiana Owusu and Mary Owusu.

ACKNOWLEDGEMENT

I would like to express my profound gratitude to the following people and institutions for their contribution to my study:

- The composition of this thesis would not have been possible without the steadfast love and support of my husband, Richard Ofosu.
- My three Boys, Kofi, Nhyira and Ayeyi
- My supervisor, Prof. Neltjie C. van Wyk, and her guidance, constant support, and advice carried me throughout all the stages of constructing my report.
- My co-supervisor, Dr. Melitha Rasweswe, for her valuable input.
- The Regional Health Director, Ghana Health Service—Ashanti region, for permitting me to conduct the research in Ghana Health Service (GHS) facilities in the region.
- The management and staff of the five participating healthcare facilities for their support and assistance.
- The Department of Nursing Science, University of Pretoria, for granting me a University of Pretoria postgraduate bursary.
- Dr Napoleon B. Sam, for the statistical analysis.
- Dr Andrews William Tetteh for his support in administrating the focus group interview.
- Mr Kennedy Nartey, regional health information officer, for his support.
- My appreciation to Elizabeth Marx from Academic and Professional Editing Services (APESpro.com) for editing and formatting my report.

ABSTRACT

Healthcare-associated respiratory infections affect patients in healthcare facilities. These infections are not present or incubating at admission time and include respiratory infections acquired by discharged patients and occupational infections among healthcare workers. COVID-19 is a rapidly expanding pandemic caused by a highly infectious novel human coronavirus. Healthcare workers lead the combat against the disease and aim to protect themselves and their patients from the virus; therefore, they have the daunting task of implementing preventive measures. Their knowledge, attitudes, and practices regarding COVID-19 may influence how much they adhere to strategies to prevent the spread of respiratory infections. Phase 1 of the study involved a quantitative cross-sectional interview to determine healthcare workers' knowledge, attitudes, and practices towards COVID-19 prevention. A structured questionnaire with Cronbach's Alpha value of 0.71 was used to collect data from 373 healthcare workers and their managers, sampled through a multistage random technique. A descriptive and inferential analysis was performed using the Statistical Package for Social Sciences (SPSS). In Phase 2, the findings of Phase 1 and an extensive literature review were used to draft strategies to prevent the healthcare-associated spread of respiratory infections. Focus group interviews with 10 healthcare managers, purposely selected from the five selected hospitals, were conducted to refine the strategy. The study established that 85.8% of the healthcare workers embraced good knowledge of COVID-19. Age and religious affiliation were significantly associated with factors affecting the knowledge level about the novel coronavirus disease; 56.6% of the participants had a good attitude towards COVID-19. The duration of the experience and marital status of the participants were strongly associated with their attitudes. Less than 50% of the participants had excellent preventive practices for COVID-19. Gender, level of education, and source of information were associated with the participants' practices towards COVID-19 prevention. Ten strategies were developed during Phase 2 to prevent healthcare-associated spread of respiratory infections. These strategies include ensuring triage, early recognition, source control, applying standard and transmission precautions, education and training of healthcare workers, engineering controls, active surveillance programme for staff, visitors, and patients with acute respiratory infections, restriction of visitors and caregivers, vaccination of healthcare workers as recommended by the World Health Organization and the Ministry of Health promotion of healthy behaviours to strengthen the immune system, adequate supply of personal protective equipment, monitoring and evaluation, and investing in research. Preventing the spread of respiratory infections in the healthcare setting is imperative. Strategies to avoid the healthcare-associated spread of respiratory infections have been developed and presented based on the current study's findings.

Keywords: COVID-19; strategies; prevention; Ghanaian healthcare workers; respiratory infections

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ABM	Aerosol barrier mask
AGREE	Appraisal of Guidelines, Research, and Evaluation
ASU	Arizona State University
CDC	The Centres for Disease Control and Prevention
CI	Confidence interval
COVID-19	Coronavirus Disease-2019
ENT	Ear Nose and Throat
GHS	Ghana Health Service
GI	Gastrointestinal illness
HBM	Health belief model
HCAI	Healthcare associated Infections
HCoV	Human coronavirus
HCWs	Healthcare workers
HDFT	Harrogate and District Foundation Trust
HHCAR	Hand hygiene complete adherence rate

HHTAR	Hand hygiene total adherence rate
HVAC	Heating ventilation and air conditioning
ICU	Intensive care units
IPC	Infection prevention and control
JBI	Joanna Briggs Institute
KAP	Knowledge, attitude, and practice
KGCMH	Kaohsiung Chang Gung Memorial Hospital
LDHF	Low-dose, high-frequency
MOH	Ministry of Health
PCC	Participants, concept, and context
PCR	Polymerase chain reaction
PPE	Personal protective equipment
QI	Quality improvement
RRT	Rostered routine testing
SA	Strongly agree
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus-2
SD	Strongly disagree

SD	Standard Deviation
SEIR	Susceptible exposed infectious recovery
SIRD	Susceptible-infected-recovered-dead
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

LIST OF APPENDICES

CHAPTER ONE
INTRODUCTION TO THE STUDY

1.1. Introduction

The Coronavirus disease-19 (COVID-19) is not the first and will most probably not be the last respiratory pandemic that the world experiences. Influenza and coronaviruses have historically infected people with pandemic potential. As early as 1510, the influenza virus caused epidemics and pandemics, such as the Spanish, Asian, and Hong Kong flu. Three deadly coronaviruses lead to the loss of several lives since the discovery of the Severe Acute Respiratory Syndrome Virus (SARS-CoV) in 2003 in the Guangdong province of China, the Middle East Respiratory Syndrome Virus (MERS-CoV) in 2013 in Jeddah, Saudi Arabia, and the Severe Acute Respiratory Syndrome Virus-2 (SARS-CoV-2) in 2019 in Wuhan, China (Piret & Boivin, 2020:4-9).

Several novel coronaviruses emerged from zoonotic reservoirs in recent decades, causing severe lower respiratory disease, especially the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), causing the current COVID-19 pandemic (Petrie & Talbot, 2021:1056). There have been other instances of novel human coronavirus (HCoV) emergence causing pandemics, although the COVID-19 pandemic is the first known caused by Human coronavirus. There has been multiple healthcare-associated spread of MERS; 13% to 70% were among healthcare workers(HCWs) (Barry et al., 2020:1). The influenza A (H1N1) pandemic in 2009, the emergence of the influenza A (H5N1), SARS-CoV, and the SARS-CoV-2 pandemic prompted a rise in patient screening for respiratory infections. Preventive measures for COVID-19 have increased the importance of infection prevention and control measures to prevent intra-hospital spread of respiratory illnesses, providing an opportunity to change practice for other respiratory infections (Yamaguto et al., 2022:188).

COVID-19 spreads from person-to-person through the inhalation of aerosols from infected Individuals (Li et al., 2020:119). Patients with comorbidities, such as hypertension, cardiac diseases, lung diseases, cancer, and diabetes, are more at risk for severe illness and mortality (Shi et al., 2020:431). COVID-19 is highly infectious, and its primary clinical symptoms include fever, dry cough, fatigue, headache, and dyspnoea (Tian et al., 2020:401). It is an emerging respiratory pandemic, with the number of deaths exceeding other viral respiratory infections caused by the SARS-CoV and MERS-CoV (World Health Organisation(WHO), 2003:1; WHO, 2019:1). During January 2020, WHO declared COVID-19 as a public health emergency of global concern (WHO, 2020b:1).

The SARS-CoV-2 caused a global pandemic. Among the critical matters are healthcare workers' infection and healthcare-associated spread of the disease. The WHO issued interim infection prevention and control guidelines, such as social distancing, hand washing, testing, and tracing, affecting community members to limit healthcare workers' exposure to SARS-CoV-2 viruses during patient care (WHO, 2020e:1; WHO, 2020c:5). These workers are at the frontline of the COVID-19 response, daily exposed to the pathogen (WHO, 2020d:5). Unfortunately, healthcare workers experience significant challenges to adhere to the guidelines (Houghton et al., 2020:5). One such reason is limited knowledge of the disease (Kenny, 2020:1).

1.2 Healthcare workers' knowledge, attitudes, and practices towards COVID-19

Since the pandemic outbreak, studies have been conducted to determine healthcare workers' knowledge about the disease, their attitude towards it, and the practices they use to manage the disease. A cross-sectional web-based study conducted with 529 healthcare workers globally about COVID-19 during the first week of March 2020 reveals that 61% of healthcare workers used social media for information about SARS-Cov-2. They had a limited understanding of the transmission of the virus (Bhagavathula et al., 2020:2). In Thailand, a cross-sectional study among 637 healthcare workers indicated that 58% had average knowledge of COVID-19; 50% had positive attitudes; 80.40% had good practices towards COVID-19 (Kunno et al. 2022:8).

A study in Dubai revealed that 57.40% of 176 healthcare workers had average knowledge of COVID-19 (Albahri et al., 2021:5). Knowledge of COVID-19 among healthcare workers was low in another study in Indonesia (Jamil et al., 2020:1) Rabbani and Al Saigul established that, although there were good practices among healthcare workers in Saudi Arabia towards COVID-19, there were still divergences in their knowledge and attitudes (Rabbani & AL Saigul, 2021:1). The majority (94.8%) of the healthcare workers in the study in Pakistan indicated excellent knowledge regarding COVID-19 (Malik et al., 2020:1). This contradicts another study also conducted in Nepal, revealing divergences in healthcare workers' knowledge and practices towards COVID-19; only 45.7% of 462 had good knowledge of COVID-19 (Ghimire et al., 2020:1).

A similar study was conducted in Yemen; there were divergences in knowledge and attitude regarding COVID-19, despite the healthcare workers' adequate knowledge level and exemplary performance in preventive measures (Alrubaiee et al., 2020: 1). In Pakistan, a cross-sectional study among 414 healthcare workers was conducted. The findings suggest that they had good knowledge of COVID-19, but divergences existed in some aspects of knowledge and practice that needed attention (Saqlain et al., 2020:1). The findings of a study in Jordan among healthcare workers pointed to some knowledge, attitude, and practice divergences for COVID-19 prevention interventions (Amro et al., 2022:1).

In Vietnam, a study established a high knowledge level, attitude, and practice of COVID-19 among healthcare workers; however, 89.6% of 692 had difficulty implementing preventive measures, such as a change in their behaviour (Tien et al., 2021:4); 53.65% of 1441 healthcare workers in Venezuela had negative attitudes towards COVID-19, although they had sufficient knowledge and good preventive practices (Mendoza Millan et al., 2021:9). In Nepal, Limbu et al. established that practices correlated with improved knowledge and positive attitude towards COVID-19. They studied 103 healthcare workers, of which 53.4% had positive attitudes, and 81.5% had good practices towards COVID-19. They concluded that the training of healthcare workers and developing positive attitudes are essential to combat the infection (Limbu et al., 2020:20). A similar study in Shiraz indicated that 72.8% of 495 healthcare worker respondents had sufficient knowledge; 66.65% indicated correct attitude; 67.72% described good practices (Kamali et al., 2020:1). The results of a study in Saudi Arabia among healthcare workers, indicating knowledge, attitudes, and practices towards COVID-19, suggested the need for developing practical strategies for preventing and controlling COVID-19 infections (Bashir et al., 2021:1).

Even though the spread of COVID-19 was more prevalent in European and American countries, it was still rising in several African countries (Olum et al., 2020:1). Several studies on healthcare workers' knowledge, attitudes, and practices towards COVID-19 have been conducted in Sub-Sahara Africa. In South Africa, there was adequate knowledge, good attitudes, and satisfactory practices towards COVID-19 among healthcare worker participants (Moodley et al., 2021:9).

A study in Uganda among healthcare workers revealed that 69% of the 581 respondents had sufficient knowledge of COVID-19, but a low percentage of 21% communicated positive attitudes towards the prevention of COVID-19 infection; 74% reported that they had good preventive practices (Olum et al., 2020:3). A substantial divergence in the knowledge level of preventive practices was established among healthcare workers studied in Ethiopia, although most had positive attitudes towards COVID-19 prevention (Fetansa et al., 2021:1). Similarly, three studies were conducted in Ethiopia, where the findings revealed divergences in the preventive practices of healthcare workers regarding COVID-19 transmission (Asemahagn 2020:1; Bitew et al., 2021:1; Yesse et al., 2021:2). In Sierra Leone, 516 healthcare workers' knowledge, attitudes, and practices towards

COVID-19 were studied. The study results revealed good COVID-19-related knowledge, attitude, and practices; however, their facilities were not adequately prepared to respond to the COVID-19 pandemic (Kanu et al., 2021:1).

A Nigerian study of 300 healthcare workers revealed that over 90% of the participants responded correctly to questions to assess their knowledge of COVID-19. They were highly aware of the aetiology, mode of spread, and symptoms of COVID-19 (Ogolodom et al., 2020:2). Another two studies were also conducted in Nigeria, and all the studies revealed that despite the healthcare workers having good knowledge, their practices towards COVID-19 prevention were unsatisfactory (Abene et al., 2021:5; Ayinde et al., 2020:1).

A survey of healthcare workers' knowledge, practice, and preparedness to manage COVID-19 in the Offinso-North District in Ghana revealed that 65.1% of the participants had adequate knowledge of the disease; however, only 27.6% received applicable in-service training (Nkansah et al., 2020:3). Researchers globally studied the knowledge, attitudes, and practices of healthcare workers regarding COVID-19 to understand how they react to the current pandemic.

1.3 Problem statement

On 12 March 2020, doctors diagnosed the first two COVID-19 patients in Ghana. According to their records, these patients returned from Norway and Turkey, where they most probably were infected with the SARS-CoV-2. These two cases began the first contact tracing process in Ghana (Duncan, 2020:1). As of 24 July 2020, Ghana had 30,000 COVID-19 cases and 153 deaths, making it the country with the fourth-highest number of cases in Africa and 54th globally (WHO, 2020f: Situation update). The Ashanti region had 5841 confirmed cases on July 16, 2020 (Ghana Health Service (GHS), 2020:

COVID-19 Update). Figure 1.1 demonstrates the cumulative cases of COVID-19 in Ghana by region between March 2020 and February 2021.

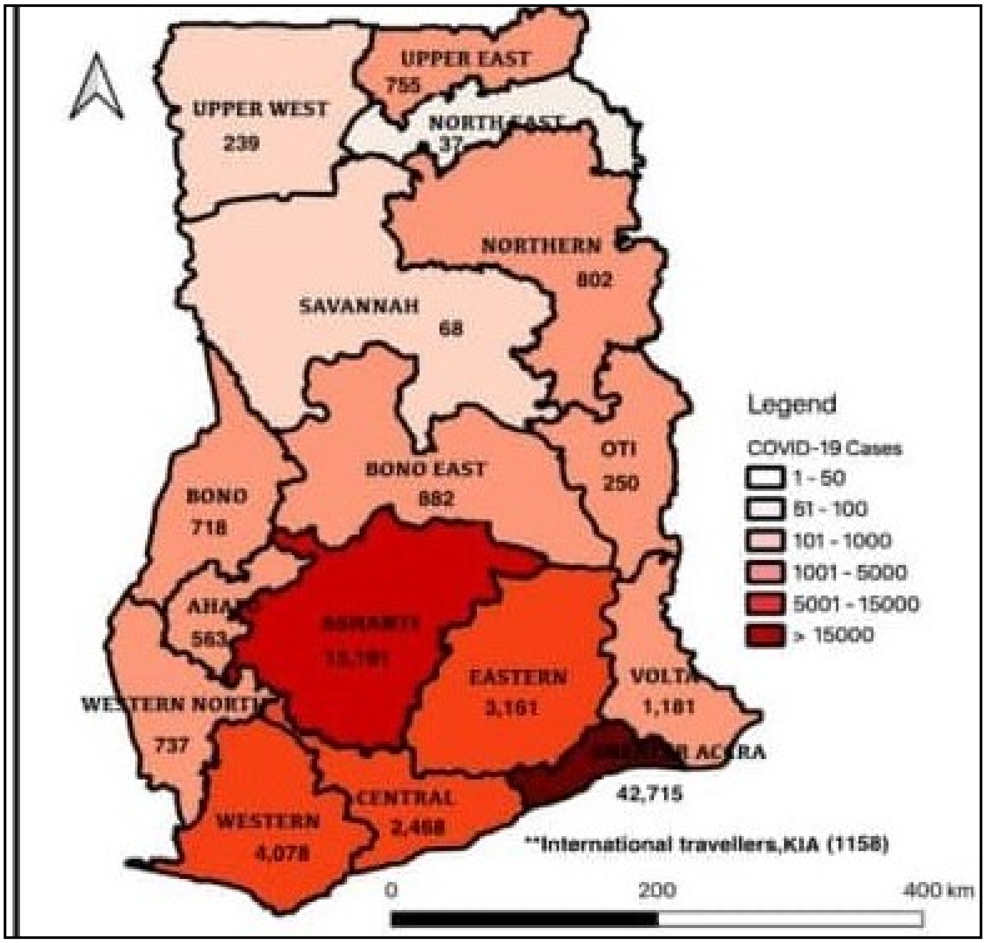


Figure 1.1: Cumulative cases of COVID-19 in Ghana by region, March 2020 to February 2021

(GHS COVID-19 update, 2021)

Several SARS-CoV-2 infected patients report primarily mild symptoms, contributing to the difficulty in detecting them during the preliminary stages of the disease. They only report to healthcare services when they develop severe symptoms. Early identification, treatment and isolation is, therefore, a challenge. It leaves preventive measures as the best control mechanism.

Preventive strategies focus on minimising exposure to the virus. Wearing personal protective equipment (PPE), regular handwashing with soap, observing physical distancing, and covering coughs and sneezes with a flexed elbow or tissue paper are the only mechanisms to curb the spread of the virus (Cascella et al., 2020: para14). Ghana also called for a partial lockdown in some regions (Greater Accra Metropolitan Area and Greater Kumasi regions) on 30 March 2020, like several governments globally, allowing only critical services, such as hospitals, grocery stores, medical equipment, and frontline emergency services to operate (APA News, 2020:1). The government implemented several measures to avoid the rapid spread of the ongoing COVID-19 outbreak from March 2020. The Government closed all schools and borders during severe episodes of COVID-19. Domestic and international flights were suspended. Virtual meetings were replacing large gatherings of people.

As in the rest of the world, the SARS-Cov-2 infected healthcare workers in Ghana. On 20 May 2020, 30 healthcare workers tested positive for the virus in the Ashanti Region during their line of duty. They were frontline workers managing the disease in the region (Hope, 2020:1). Ninety-seven health workers in the Ashanti region contracted the virus on 18 June 2020, of which one person died. Eighteen were doctors, and 47 were nurses, with the remainder being auxiliary workers, such as cleaners, contact tracers, and administrative staff (Donkor, 2020:1).

The healthcare workers in Ghana followed the WHO interim guidelines for preventing and controlling COVID-19. The Ministry of Health(MOH) also published provisional standard treatment guidelines for COVID-19 and encouraged the training of all healthcare workers to protection from the virus and to prevent its spread (Ministry of Health [MOH], 2020:1-33). Despite their training, some healthcare workers in Ghana, and unfortunately in the

Ashanti region, lacked adequate knowledge regarding the disease. Even people with sufficient knowledge do not always apply that in their practice (Nkansah et al., 2020:3). Usually, in institutions in Ghana, healthcare workers do not observe the protocols (Ghana web, 2021:1). Not all the healthcare facilities in Ashanti had sufficient resources, such as PPE and isolation facilities for suspected COVID-19 cases. Delayed test results of potential patients also lead to unnecessary exposure and infections of healthcare workers (Ghana Medical Association Report, 2020:1; Hope, 2020:1; Ghana Medical Association Report, 2021:1). In the northern region of Ghana, the Savelugu hospital closed for two weeks following an outbreak of COVID-19 among hospital staff and patients (Ghana News Agency, 2021:1).

A lack of knowledge of healthcare workers resulted in delayed identification and treatment of COVID-19 patients and a rapid spread of SARS-CoV-2 infections. Negative attitudes regarding their own responsibilities towards preventing the spread of COVID-19 and poor practices of preventive protocols in managing COVID-19 patients put themselves, their patients, and the community at risk (Karlsson & Fraenkel, 2020:1; Zhiruo et al., 2020:231). The healthcare workers who contracted COVID-19 transmitted the infection to their colleagues, families, relatives, and friends (Shah et al., 2020:1).

To guarantee the control of respiratory infections, such as the COVID-19 infection, healthcare workers' knowledge of prevention and control measures is essential. It is also important to determine the factors affecting their attitude to have adequate practices to early diagnose and treat patients and prevent the spread of infections. This study, therefore, sought to investigate the KAP of healthcare workers in the Ashanti region of Ghana towards COVID-19 and to use it in developing and refining strategies to prevent healthcare-associated spread of respiratory infections.

At the time of the study, WHO strategies to prevent the spread of COVID-19 were used. The strategies were generic and not substantiated with information regarding the knowledge, attitudes, and practices of the healthcare workers of the Ashanti region. Generic strategies are insufficient and, therefore, have limitations (Pretorius, 2008:19). The study includes detailed information regarding the situation's unique circumstances and knowledge of the people involved (Bolisani & Bratianu, 2018:147-174).

1.4 Research questions, aim, objectives, hypotheses

The following research questions applied:

1) What is known about the KAP towards COVID-19 among healthcare workers in the Ashanti region of Ghana?
2) What are some strategies to prevent the healthcare-associated spread of respiratory pandemics, informed by the evaluation of the knowledge, attitudes, and practices of healthcare workers regarding COVID-19?

The study aimed to determine the healthcare workers' knowledge, attitudes, and practices towards COVID-19 and to develop and refine strategies to prevent the healthcare-associated spread of respiratory infections.

The objectives of Phase 1 were:

1) To describe the knowledge-level of healthcare workers regarding COVID-19 in the Ashanti region, Ghana.
2) To describe the attitude of healthcare workers towards COVID-19 in the Ashanti region, Ghana.
3) To describe the practices of healthcare workers towards preventing the spread of COVID-19 in the Ashanti region, Ghana.
4) To determine the relationship between the healthcare workers' gender, age, religion, marital status, highest level of education, duration of the experience at work,

occupation (specialisation) and place of work and their knowledge, attitudes, and practices regarding COVID-19.

The objective of Phase 2 was:

To develop and refine strategies to prevent healthcare-associated spread of the current pandemic and similar future respiratory pandemics in the Ashanti region, Ghana.

These hypotheses applied for Phase 1:

COVID-19 KAP have no relation to healthcare workers' gender, age, religion, marital status, highest level of education, duration of the experience at work, occupation (specialisation) and place of work.

- H0: COVID-19 KAP has no relation to the biographic data of healthcare workers.
- H1: COVID-19 KAP has a relation to the biographic data of healthcare workers.
- H0: COVID-19 KAP has no relation to healthcare workers' duration of experience.
- H1: COVID-19 KAP has a relation to healthcare workers' duration of experience
- H0: COVID-19 KAP has no relation to healthcare workers' specialisation.
- H1: COVID-19 KAP has a relation to healthcare workers' specialisation
- H0: COVID-19 KAP has no relation to healthcare workers' place of work
- H1: COVID-19 KAP has a relation to healthcare workers' place of work

1.5 Definition of key terms

The **coronavirus disease - 2019 (COVID-19)** is an infectious disease caused by a newly discovered coronavirus called SARS-CoV-2 (WHO, 2020a:1). The mode of transmission of the infection is mainly person-to-person through respiratory droplets. The faecal-oral route is also possible. The incubation period is between two to 14 days (Azer, 2020:2). The SARS-COV-2 enters the host cells through the S spike protein by binding to the

Angiotensin-converting Enzyme 2 (ACE2) for internalisation and aid by TMPRSS2 protease. The high infectivity relies on developing mutations in the receptor-binding domain. The virus interaction with ACE2 may downregulate the anti-inflammatory function to increase angiotensin II effects in predisposing patients. The invasion of the virus to the lung cells, myocyte, and endothelia cells of the vascular system causes inflammatory changes. These changes contribute to lung injury pathogenesis, hypoxia-related myocyte injury, body immune response, increased damage of myocardial cells, and intestinal and cardiopulmonary changes (Azer, 2020:2). In this study, COVID-19 refers to the description above.

A **healthcare worker** delivers care and services to the ill and ailing directly as doctors and nurses or indirectly as aides, helpers, laboratory technicians, and even medical waste handlers (Joseph & Joseph, 2016:71). For this study, healthcare workers refer to healthcare professionals (nurses, midwives, medical officers, and allied healthcare professionals) and maintenance staff in primary contact with COVID-19 patients.

Knowledge in KAP surveys refers to the understanding of a community on any topic (Kaliyaperumal, 2004:7). For the study, knowledge refers to familiarity and awareness of healthcare workers about COVID-19 and preventive measures.

An **attitude** refers to a set of emotions, beliefs, and behaviours towards an object, person, or event (Cherry, 2021:6). Attitude in this study relates to the way healthcare workers think and behave towards COVID-19 and preventive measures. It refers to the concepts of perceived susceptibility to COVID-19, severity of COVID-19, benefits of the prevention of COVID-19, barriers to behaviour change and self-efficacy of the health belief model.

Practices in KAP surveys refer to using diverse healthcare options to yield information on people’s behaviour (Ul Haq et al., 2012:2). In this study, practice relates to the habitual healthcare workers' involvement to prevent COVID-19 in caring for patients during the pandemic.

Healthcare-associated infections are infections that occur while receiving healthcare, developed in a hospital or other healthcare facility that first appear 48 hours or more after hospital admission or within 30 days after having received care (Haque et al., 2018:1). These infections spread among patients, and from patients to healthcare workers and healthcare workers to patients. Healthcare-associated respiratory infections became a well-known feature of respiratory pandemics and the leading means of spread (Al-Tawfiq & Auwaerter, 2019:1). In the present study, healthcare-associated respiratory infections called the spread of COVID-19 and other respiratory infections among patients and healthcare workers.

Respiratory infections involve the sinuses, throat, airways, or lungs. It can be acute or chronic, affecting adults and children. Respiratory infections can also be community-acquired or hospital-acquired. The causative pathogen can be viral, bacterial, fungal, or parasitic (Niederman & Torres, 2022:1). In the current study, respiratory infection refers to infections affecting the respiratory system acquired in the hospital setting.

Strategies indicate the direction and scope of an organisation over the long-term, which achieves advantage in a changing environment by configuring resources and competencies to fulfil stakeholder expectations (Johnson et al., 2008:40). Mintzberg (1978:935) defines strategy as a pattern in a stream of decisions and actions. The author opined that strategies do not necessarily arise from logical planning but may also result from what is unplanned. Mintzberg distinguishes between intended and emergent strategies, where intended strategies refer to the plans the manager developed, and emergent strategies relate to the activities. In this study, strategies developed and refined by the healthcare managers are called intended strategies, and the emergent strategies are the actions/practices the healthcare workers implement to prevent the healthcare-associated spread of respiratory infections.

1.6 Context/setting

The study was conducted in the Ghana Health Service facilities in the Ashanti region. The GHS functions under the Ministry of Health in Ghana—586 healthcare facilities in the region range from academic hospitals to primary healthcare clinics. Most facilities are governmentally managed, and others by missionaries and private companies (GHS Ashanti region health directorate, 2021). Ashanti had one laboratory for COVID-19 testing—the Kumasi Centre for Collaborative Research. Three centres specialise in COVID-19 patient treatment—the Komfo Anokye Teaching Hospital, the Kumasi South Hospital (a regional hospital), and the Kwame Nkrumah University of Science and Technology Hospital. When the treatment hospitals could not accommodate more patients, other facilities were used. From March 2020 to 8 June 2021, 15,378 patients received treatment for COVID-19 in Ashanti (GHS Report, 2021: Situation update).

Geographically, the Ashanti region is in the middle of Ghana, with a population of 4,780380 according to the 2010 population and housing census, with 43 districts and 188 sub-districts. The population depends on farming, mining, trading, and mechanical industries. A small percentage of the population does administrative work.

1.7 Summary of the study design

In the first phase of the study, a quantitative cross-sectional survey was conducted to determine the healthcare workers' KAP regarding the prevention of the spread of a respiratory infection (COVID-19) was conducted. A questionnaire constructed from sections of the instruments of Limbu et al. (2020) and Kamali et al. (2020) was used to collect data from 373 healthcare workers identified through a multistage random sampling technique from five designated healthcare facilities in the Ashanti region of

Ghana. The Stata and SPSS applied in the descriptive and inferential analysis of the data. In Phase 2, the findings of Phase 1 apply and the outcome of a comprehensive literature review to draft strategies to prevent the spread of healthcare-associated respiratory infections. The drafted strategies were compiled to meet the criterion of the AGREE (Appraisal of Guidelines, Research, and Evaluation) device (Brouwers et al., 2017:7). The strategies were refined through a qualitative study and focus group interviews with ten healthcare managers from the designated facilities. Chapter Two presents a comprehensive description of the research methodology.

1.8 Philosophical assumptions

The philosophy of pragmatism fits the planned research. It refers to a worldview focusing on “what works” rather than being considered absolutely and objectively “true” or “real” (Frey, 2018:28). The primary philosophical assumption of pragmatism is that knowledge and reality are uncertain, can change over time, and is socially constructed (Kausihik & Walsh, 2019:3). The pragmatist paradigm supports quantitative and qualitative research methods providing evidence to sustain optimal practice. Pragmatism concerns action, change, and the interplay between knowledge and action. It is appropriate for research approaches to intervene in the world and not merely observe it (Goldkuhl, 2012:2).

This study employed quantitative and qualitative methods to answer the research questions. The pragmatic approach determined the KAP of healthcare workers regarding COVID-19 and developing and refining strategies to prevent the healthcare-associated spread of the current and future similar respiratory pandemics in the Ashanti region, Ghana.

Ontological assumption: Ontology is the study of reality and opinions about reality (Mitchell, 2018:9). Pragmatists observe reality as context-specific. They observe reality as true concerning satisfactory relations with other parts of experiences (Kausihik &

Walsh, 2019:1). While other philosophers focus on reality, pragmatists emphasise the nature of experiences (Morgan, 2014:27). Pragmatists also believe that reality is associated with contextual circumstances and studied through human experiences (Morgan, 2014:28). Singular and multiple realities exist and, therefore, researchers use various methodologies to explore realities (Creswell & Clark, 2018:38).

Epistemological assumption: Epistemology is a way of understanding and explaining how we know the world and the relationship between the ‘knower’ and the ‘known’. It also approaches ‘how and where’ researchers generate knowledge (Kausihik & Walsh, 2019:4; Goldkuhl, 2012:10). Pragmatists collect data by “what works” to guide research questions (Creswell & Clark, 2018:38). The usefulness of the data equals the quality of the data (Creamer, 2018:46).

Methodological assumption: The methodological assumption approaches the selected research approach to guide the research questions (Creswell, 2015:4). Pragmatists rely on abductive reasoning to move back and forth between deductive and inductive reasoning (Creamer, 2018:46). Quantitative and qualitative methodologies apply if they fit the research question and the setting. The study employed a quantitative methodology in the first phase and a qualitative methodology in the second phase.

1.9 Delineation

This study was delineated to determine the healthcare workers’ KAPs regarding COVID-19 and how it informed developing and refining strategies to prevent healthcare-associated spread of respiratory infections. Other aspects that might have influenced the healthcare-associated spread of respiratory infections are omitted.

1.10 Theoretical frameworks

The study applied two theoretical frameworks—The KAP is a behaviour change theory founded by Schwartz (1976). It explains behavioural change. Researchers often use it to study human attitudes and behaviour. It is based on the social learning theory by Albert Bandura and includes several aspects of the diffusion of innovation theory by Everett Roger (Hamid et al,2014:1). The KAP model attempts to understand the relationships between three constructs, such as knowledge, attitude, and practice. The theory explains 'knowledge' as "the foundation of behaviour change and attitude are the driving force of behaviour change" (Fan et al., 2018:2). This study assessed the healthcare workers' level of KAP towards the COVID-19 outbreak in the Ashanti region of Ghana in Phase 1. The results guided Phase 2, where strategies are developed and refined to prevent the spread of healthcare-associated respiratory infections.

The health belief model (HBM): A conceptual framework for predicting and explaining whether a person will act to prevent a specified health condition. The social psychologists Hochbaum, Rosenstock, and Kegels developed the model in 1950 while employed by the United States Public Health Service to explain health-related behaviours (Rosenstock, Strecher, & Becker, 1988:176). Researchers use the model to identify convincing points for behaviour change based on the principle that people are attracted by positive values (Maseko et al, 2019:9). The HBM posits that these opinions or perceptions interact within an individual to determine the person's "readiness to act" to change their behaviour.

Perceived susceptibility: The person's belief about whether they are inclined to contract the adverse health condition (disease). It, therefore, refers to the vulnerability of the SARS-CoV-2 infection and the spread of the virus to other people (Wong et al., 2020:2206). The higher the perceived likelihood of contracting the disease, the higher the perceived susceptibility.

Perceived severity: Refers to the person's belief about the extent of the adverse effects of contracting the disease (Wong et al., 2020:2206). The adverse effects include the possibility of pain, disability, death, job losses, and family problems. Perceived susceptibility and severity together determine a person’s perceived threat of the condition. A high perception of a threat of the condition leads to an increased sense of danger; therefore, there is a high likelihood of performing the preventive action (Affedzie, 2017:2).

Perceived benefits: Refer to the person's belief in how effective a preventive action will be in preventing him from contracting the disease (Wong et al., 2020:2206). The higher the effectiveness of the proposed preventative measure, the higher the perceived benefits. The persons should perceive that the target behaviour would reduce the likelihood of a negative outcome. They should also perceive that the target behaviour would provide substantial positive benefits (Carpenter, 2010:662).

Perceived barriers: Refer to the persons perceiving there are substantial barriers that prevent them from adopting the preventive behaviour. When the barriers are substantial, they are unlikely to adopt the target behaviour (Carpenter, 2010:662).

Cues to action: Refer to a person's inner opinions to implement the target behaviour. Immediate environmental cues encourage behaviour change (Tarkang & Zotor, 2015:5).

Self-efficacy: Refers to the person’s belief in their ability to implement the target behaviour. The more people believe they are capable, the more efficient they feel and the more likely they will succeed (Tarkang & Zotor, 2015:5).

Modifying factors: Refer to factors that may influence behaviour change. It includes the person’s age, sex, ethnicity, personality, knowledge, and socioeconomic status (Tarkang & Zotor, 2015:4).

The study adopted these HBM components: perceived susceptibility, severity, barriers, benefit, and self-efficacy. This was used to explain the healthcare workers' attitude towards COVID-19. Modifying factors (demographic and biographic information and economic factors) were used to describe their influence on COVID-19 prevention among healthcare workers and their patients.

The following conceptual framework was applied:

The **independent variables in the framework** refer to the socio-demographic details (gender, age, highest level of education, duration of experience, occupation and specialisation, place of work, and COVID-19 information sources).

The **dependent variables in the framework** refer to the KAPs of the healthcare workers regarding COVID-19.

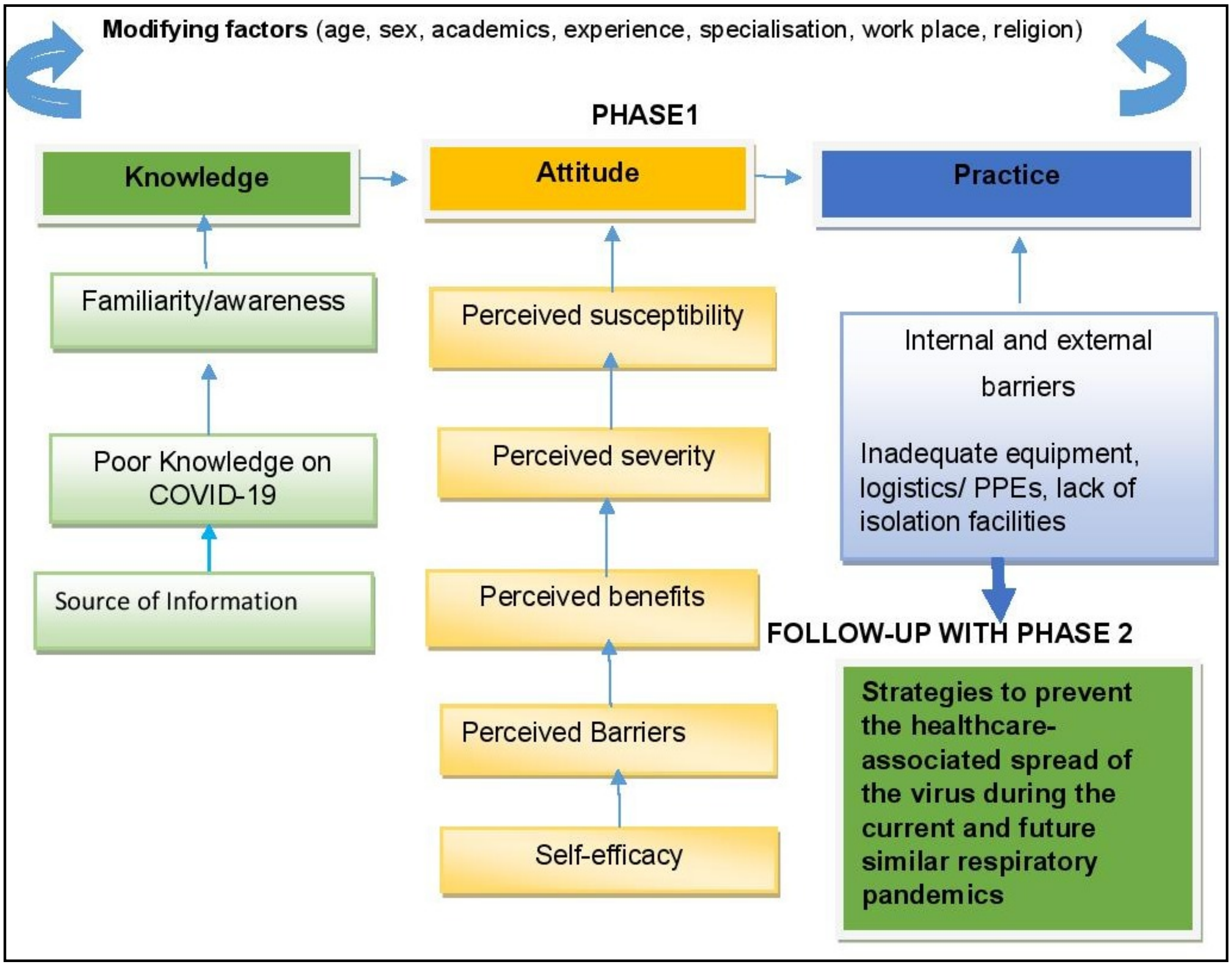


Figure 1.2: Conceptual framework

The conceptual framework (Figure 1.2) determines the KAPs among healthcare workers towards infection and spread of COVID-19 and developing and refining strategies to prevent the healthcare-associated spread of respiratory infections.

The framework refers to the change of practices through the adjustment of attitude. An increase in knowledge adjusts attitude according to the HBM. The study integrated the HBM and the KAP model, as indicated in the conceptual framework. It demonstrates that the correcting of attitudes through knowledge leads to a change of practices. In this study, the practices refer to the prevention of infection and spread of SARS-CoV-2. According to the framework and diagram, limited knowledge, and inexperience in using appropriate PPE and other preventive and control measures can diminish a person's self-efficacy in combating COVID-19. If the healthcare workers obtain insufficient information from the right source, such as the WHO guidelines for COVID-19 prevention of the infection and spread, it detrimentally affects their attitude towards COVID-19. Attitude in this study refers to emotions, beliefs, and behaviours towards an object, person, thing, or event. Whether a person will act to prevent COVID-19 infection and spread depends on their attitude (perceptions or beliefs) about the disease.

Perceived susceptibility to COVID-19: If the healthcare workers believe they are susceptible to COVID-19 and, therefore, capable of spreading the virus, they will implement the recommended preventive guidelines.

Perceived severity of COVID-19: If healthcare workers believe that an infection with COVID-19 is a severe and fatal condition, they will be more inclined to practise the recommended preventive guidelines.

Perceived benefits of practising COVID-19 preventive measures: If the healthcare workers believe that practising the recommended preventive guidelines will reduce the chances of contracting COVID-19, they will practise.

Perceived barriers against COVID-19 prevention: If excessive inconveniences are involved in practising the COVID-19 recommended preventive guidelines, healthcare workers will not practice them. Factors that prevent a person from practising the guidelines include inadequate equipment (equipment for hand hygiene, inadequate PPE, and inadequate space to practise social distancing). These perceived barriers may discourage a person from practising the recommended guidelines despite knowing their benefits and the threat of the disease.

Perception of self-efficacy in adhering to COVID-19 protocols: If persons believe that they can wash hands with soap under running water, observing social distancing of three feet/two meters, wearing appropriate PPE, using alcohol-based sanitisers, wearing face masks will prevent them from contracting COVID-19, then their likelihood of practising them will be significantly enhanced.

Modifying factors: Include socio-demographic and economic characteristics that can enhance or diminish the likelihood that a person will practise COVID-19 preventive guidelines. An individual may also have adequate knowledge and a positive attitude towards COVID-19 prevention, but **internal and external barriers**, such as inadequate equipment and a lack of facilities, can generate poor practices.

In Phase 2 of the study, strategies were developed and refined to prevent healthcare-associated spread of respiratory infections, as indicated in the framework.

1.11 Summary

This chapter presents the study introduction. A thorough description of the problem statement, aim, objectives, and hypotheses, the assumptions of the research paradigm, and the conceptual framework are included. The subsequent chapter describes the research methodology.

CHAPTER TWO
THE RESEARCH METHODOLOGY

2.1. Introduction

The background of the study is comprehensively described in the previous chapter. The methodology concerns how the research was undertaken; the process and methods used to conduct the study are explained in this chapter.

2.2 The research design for Phase 1: A cross-sectional study on healthcare workers' knowledge, attitude, and practice towards COVID-19

Phase 1 employed a cross-sectional quantitative study to determine the healthcare workers' KAPs towards COVID-19.

2.2.1 Methodology

A cross-sectional study design is an observational study where variables are simultaneously investigated (Setia, 2016:261). A study of this nature provides findings fast and is inexpensive and, therefore, useful for public healthcare planning, monitoring, and evaluation (Setia, 2016:263). Cross-sectional designs are the most relevant when assessing the prevalence of disease, attitude, and knowledge among respondents (Kesmodel, 2018:1).

2.2.1.1 *Study population*

A study population is a subset of a target population from which the sample is selected (Hu, 2014:274). The population of the first phase of the study refers to healthcare workers (nurses, midwives, medical officers, allied healthcare professionals and maintenance staff) practising in the GHSs in the Ashanti region and who were providing care to COVID

-19 patients and other respiratory infections. According to the GHS, Ashanti Region Health Directorate, 12070 healthcare workers were employed in 2020.

2.2.1.2 *Context/setting*

The research was conducted in five GHS facilities in the Ashanti region: The Kumasi South Hospital (regional hospital), Suntreso Government Hospital, Ejisu Government Hospital, Bekwai Municipal Hospital, and Nkawie Government Hospital. The GHS functions under the MOH- 586 healthcare facilities in the region range from academic hospitals to primary healthcare clinics. Most facilities are governmentally managed, and others by missionaries and private companies (GHS Ashanti region health directorate, 2021). Geographically, the Ashanti region is in the middle of Ghana, as revealed in Figure 1.1, with a population of 4,780380 according to the 2010 population and housing census, with 43 districts and 188 sub-districts. The population depends on farming, mining, trading, and mechanical industries. A small percentage of the population does administrative work.

During the COVID-19 pandemic, one central laboratory serving the region was the Kumasi Centre for Collaborative Research. Three specialised centres that helped in COVID-19 patient treatment were the Komfo Anokye Teaching Hospital, the Kumasi South Hospital (a regional hospital), and the Kwame Nkrumah University of Science and Technology Hospital. In cases where treatment hospitals could not accommodate more patients, other regional facilities were used, and these selected facilities were included. From March 2020 to 8 June 2021, 15,378 patients received treatment for COVID-19 in the Ashanti region (GHS, 2021: Situation update). The healthcare workers in the selected facilities participated in the study. At the time of the study, the researcher was not employed in the aforementioned facilities.

2.2.1.3 *Sampling method and sample size*

Multistage random sampling is a method of obtaining a sample from a study population by dividing it into smaller groups to select representative respondents. In multistage sampling, the large groups are selected using a simple random sampling method. After that, smaller groups within those large groups are also determined using a simple random sample technique (Dunn, 2021:72). This sampling method was chosen because of its flexibility and the large study population size. The following formula was used to determine the sample size.

$$\text{Sample size, n} = \text{N} * \frac{\frac{Z^2 * p * (1-p)}{e^2}}{[N - 1 + \frac{Z^2 * p * (1-p)}{e^2}]}$$

The study population size (N) was 12 070 (GHS, Ashanti region Health Directorate). With a confidence level of 95%, population proportion (p) is 0.5, a margin of error (e) is 0.05 (5%), alpha divided by 2 (1- confidence level) is 0.025, and the Z- score is 1.96, from the above formula, the minimum required size (n) calculated was **373.**

The sampling was conducted in stages. In **Stage 1,** potential respondents were selected according to their work districts. A random selection of five from 43 districts in the Ashanti region with high cases of COVID-19 was conducted. In the **Stage 2,** five healthcare facilities were randomly selected (hospitals and clinics) in the previously chosen districts (one from each district). In the **Stage 3,** 75 healthcare worker respondents were randomly selected from each of the selected healthcare facilities. A statistician ensured that all the designated healthcare worker groups had proportional representation. Proportionate sampling prescribes that the number of respondents “should be selected in proportion to their occurrence in the study population” (Grove, 2017:339).

The selection of the respondents was arranged after the Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria approved the proposal, and the relevant authorities permitted the study at the selected facilities.

2.2.1.4 *Data collection and organisation*

A structured questionnaire was used to collect data. There is no standardised and validated device for assessing KAPs on COVID-19. The questionnaire was constructed from two questionnaires used and published to evaluate KAP towards COVID-19. The study used sections of the instruments of Limbu et al. (2020) and Kamali et al. (2020). Limbu et al. (2020) determined the KAP of healthcare worker respondents in a tertiary care hospital in Nepal, and Kamali et al. (2020) did a similar study with healthcare worker respondents in Iran.

The study used a 25-item questionnaire adapted from the one of Limbu et al. (2020) and modified to evaluate the respondents' knowledge regarding COVID-19 and the prevention of the spread of COVID-19. The modification was necessary to integrate context-specific material. The researcher used nine (9) items to assessed the attitude of the respondents towards COVID-19 with a Likert-item questionnaire she adapted from the one of Kamali et al. (2020). The responses refer to strongly agree, agree, neutral, disagree, and strongly disagree. The parts of the questionnaire adapted from Limbu et al. and Kamali et al. had reliability coefficients of (r =1.00) and validity coefficients of (r = 0.98), respectively, indicating perfect reliability and a useful device (Limbu et al., 2020:5; Kamali et al., 2020:5).

Practices to prevent the spread of COVID-19 were assessed by seventeen (17) items using yes/no, and lack of facility/inadequate equipment questions developed from the WHO and MOH/GHS recommended practices to prevent COVID-19 transmission. The content validity of the instrument used by Kamali et al. (2020:1-8) was validated by a collaboration panel of professionals from the Internal Medicine and Epidemiology Department of Shiraz University of Medical Science. The study did the same by using a panel of multidisciplinary healthcare professionals from the designated healthcare services where the study was conducted to validate the adjusted instrument. The reliability of the adjusted device was determined through the calculation of a Cronbach's alpha value, as was conducted by Kamali et al. (2020:1-8) with the original instrument. The Cronbach's alpha value for the study was (0.71).

Knowledge and attitude were assessed using a five Likert scale, and scoring were conducted by assigning numbers 1-5 to the scale: strongly agree -**5** agree -**4** neutral -**3**, disagree - **2**, strongly disagree -**1**. The more frequent answer of 4-5 revealed adequate knowledge and a positive attitude, whereas limited knowledge and negative attitude were indicated by more frequent scores of 3 and below.

The scoring of the practices of HCWs towards COVID-19 prevention was conducted by assigning 0 to an incorrect answer and 1 to a correct answer. The practice questions were 17 with three options (Yes, No, and lack of facility/inadequate equipment). The Total score was calculated and divided by the number of questions and later multiplied by 100 to obtain the cumulative percentage. A percentage (%) of 80 and above score was considered an indication of excellent practices, 60%-70% indicated acceptable practices, and below 60% signifies poor practices.

According to Kusi (2012:57), a structured questionnaire has predetermined standardised questions or items to collect numerical data for statistical analysis. The questionnaire comprises 60 items, of which almost all are close-ended questions. In Part 1, the bio-demographic information involves questions about the respondent's age, gender, marital status, religion, occupation (specialisation), place of work, the highest level of education, length of work experience, and source of information on COVID-19. Part 2 focused on questions about the respondents' knowledge of COVID-19. Part 3 included questions on the respondents' attitude towards COVID-19, and in Part 4, the respondents answered questions about COVID-19 prevention. Appendix G includes a copy of the questionnaire.

2.2.2 Pilot study

A pre-test of the instrument was conducted with a group of healthcare workers at a hospital in the Bono region, omitted in the data collection. The hospital is not in the Ashanti region but also delivers care to COVID-19 patients. The staff composition is similar to that of the hospitals in the Ashanti region; 30 healthcare workers from the hospital were involved. Their responses helped to refine the instrument. Informal permission was sought to conduct the pilot study.

Written permission to conduct the research was obtained from the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria (reference no. 357/2022) before data collection (Appendix A). Permission to conduct the study in the selected healthcare facilities was obtained from the Regional Director of Health, GHS, Ashanti Region (Appendix B).

Information sessions were arranged at the selected hospitals to inform the potential respondents about the study. The researcher and two research assistants explained that the participation is voluntary, and should they choose not to participate or to withdraw at some stage; it will have no negative implications. She and the research assistants (two final-year students from the Nursing department of Kokofu Nursing Training College) kept all information that the respondents provided confidential. The potential respondents were guaranteed that no person who would read the thesis could associate the findings with specific individuals. The participants were provided ample time to complete and submit the questionnaires. Appendix E includes a copy of the informed consent document.

2.2.2.1 *Data analysis*

The study used the SPSS Version 23 Software and Excel for the descriptive and inferential analysis of the data, with the assistance of a biostatistician (Appendix C) for confirmation. The data collected were entered into a Microsoft Excel sheet and coded for anonymity. The data entered was then exported into SPSS version 23 for analysis. The findings are presented in tables and figures (presentation of the findings is in Chapter Three).

2.2.2.2 *Statistical analysis*

The researcher and the statistician calculated descriptive statistics as frequency, percentage, mean, and standard deviation. For the inferential statistics, data were analysed using the Pearson Chi-square test. A 95% confidence interval of <0.05 will be statistically significant (Tappen,2016:362-367). The Chi-square (x^2) is useful for analysing differences in categorical variables nominal in nature, and it is also used to test whether two variables are related or interdependent with one another.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

X^2 =Chi-square

O_i = Observed value

E_i = Expected value

Testing the hypotheses: The researcher and statistician used the Chi-square test to determine the correlation between HCWs' gender, age, religion, marital status, the highest level of education, duration of the experience at work, occupation (specialisation), place of work and their KAP of COVID-19.

According to the HBM, a person's attitude (perception/beliefs) influences a person's behavioural change towards disease prevention. The modifying factors (including socio-demographic factors) affect a person's perception and, therefore, indirectly influence health-related behaviour. Based on the research objective, the correlation between the attitude of the HCWs and their practices towards COVID-19 prevention was identified.

2.2.3 Rigour

The study employed a suitable measurement instrument in the data collection. Parts of the instruments of Limbu et al. (2020) and Kamali et al. (2020) were used in the questionnaire. A reliability coefficient of r=1.00 and a validity coefficient of r=0.98 apply (Limbu et al., 2020:5; Kamali et al., 2020:5). The researcher employed experts in research and in the measuring of KAP to evaluate the instrument for face and content validity. Their comments were used to improve the instrument. A pre-test of the instrument was conducted. Please refer to 2.2.2 for more information. All necessary changes in the instrument were implemented before the data collection commenced. The researcher trained the research assistants, ensuring that all the respondents were treated in the same manner and that the data was collected similarly (Tappen, 2016:151). The respondents completed the questionnaires independently and at their preferred venues. The researcher and her assistants did not influence them; therefore, the findings were unbiased.

2.3 Research design for Phase 2: development and refinement of strategies to prevent healthcare-associated spread of respiratory infection

2.3.1 Drafting of the strategy

In Phase 2 of the study, the researcher used the findings of Phase 1 and the outcome of a comprehensive literature review to draft a set of strategies to prevent the healthcare-associated spread of the current and future similar outbreaks of respiratory infections.

2.3.1.1 *Methodology of the literature review*

A scoping review is used to identify the divergence in the knowledge base on a specific subject, set research agendas, and identify implications for decision-making (Tricco et al., 2016:1). A scoping review is knowledge synthesis that discourses an exploratory research question aimed at mapping key concepts, types of evidence, and divergences in research related to a defined area or field by systematically searching, selecting, and synthesising existing knowledge (Colquhoun et al., 2014:129).

In this study, the Joanna Briggs Institute (JBI)methodological framework for scoping reviews was used to explore and analyse the literature (Peters et al., 2020:2122).

Title and review question: The title refers to “strategies to prevent the healthcare-associated spread of respiratory infections”. The questions that guided the developing inclusion criteria facilitated the literature search, and provided a structure for developing the scoping review:

a) What knowledge is available to prevent healthcare-associated spread of respiratory infections/pandemics?
b) What strategies/guidelines/measures focusing on the positive change of KAPs have been researched?

Inclusion criteria: The participants, concept, and context (PCC) framework informed the inclusion and exclusion criteria of articles (Pollock et al., 2021:2107). In this study, the healthcare workers (population), prevention of the healthcare-associated spread of respiratory infections/pandemics (concept) in healthcare facilities (context) applied.

Participants: The inclusion criteria should specify the essential characteristics of the review's participants (Pollock et al., 2021:2107). The researcher searched through the electronic database, such as Science Direct, PubMed, Google, Google Scholar, and the WHO library. The identification of the studies was conducted by searching studies published in English between 2020-2023, using the keywords, such as "strategies, guidelines, measures, prevention, infection prevention and control, healthcare-associated respiratory infections, healthcare acquire respiratory infections, COVID-19, and respiratory pandemics". The assistance of the research librarian was sought to help with the scoping review.

Concepts: The scoping review's main concepts should be explained. Depending on the objective and questions, the concept may include details similar to those in a traditional systematic review, such as interventions, phenomena of interest, or outcomes (Peters et al., 2020:2123). The principal concept in this review is preventing the healthcare-associated spread of respiratory infections. Additional components of the central concept were indicators to prevent healthcare-associated respiratory infections; people responsible for the prevention of the healthcare-associated spread of respiratory infections; resources needed to prevent the healthcare-associated spread of respiratory infections; and the outcome of preventing the healthcare-associated spread of respiratory infections.

Context: A scoping review's context will vary depending on the objective and question. It may include geographic location, social, cultural, or sex-based factors and setting specifics (Peters et al., 2020:2123). The setting specifics in this review refer to all healthcare facilities, including rural and urban.

Types of evidence sources: A scoping review can include any literature, such as primary studies, systematic reviews, meta-analyses, letters, guidelines, websites, and blogs (Peters et al., 2020:2123). In this study, quantitative, qualitative, and mixed methods research and literature reviews were included. The scoping review includes all documents discoursing the aforementioned review question.

Search strategy: A comprehensive search from all databases was conducted, with the input of a research librarian in designing and refining the search. Clear and detailed documentation of the search strategy was kept enabling the repetition of searches (Peters et al., 2020:2123). An iterative search is envisaged as additional keywords and sources may help the researcher become more familiar with the evidence base. Only research reports and literature reviews published in English were searched.

Evidence screening and selection: The articles were screened first by title and abstract, which mention the keywords "strategies, guidelines, measures, prevention, infection prevention and control, healthcare-associated respiratory infections, nosocomial, healthcare acquire respiratory infections, COVID-19, and respiratory pandemics" in the title and abstract, followed by full texts considering the inclusion criteria. Source selection was piloted and guided by the JBI reviewer's manual for scoping reviews. The researcher then discussed articles with a research colleague to attain consensus. The selection process was narratively described and reflected in a flow diagram as indicated in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Peters et al., 2020:2124). The exclusion criteria included articles/studies published in other languages and not the English language and any study that did not report on strategies/guidelines/measures for preventing healthcare-associated spread of respiratory infections/pandemics.

Data extraction: The researcher involved two reviewers in data extraction to reduce the chance of errors and bias. Data extracted from the evidence sources align with the objectives and research question of the scoping review (Peters et al., 2020:2124). A standardised data extraction form was used to ensure consistency and minimise bias. Data extraction in scoping reviews can be an iterative process, often requiring multiple refinements to best meet the objectives and research questions of the scoping review.

Data analysis: A descriptive literature analysis was conducted through basic coding by organising data into categories (Peters et al., 2020:2125). The categories and sub-categories of the scoping review were integrated with the findings of Phase 1 as drafted guidelines.

Presentation of results: The presentation of the results in scoping reviews first describes the results of the search strategy, including a PRISMA-ScR flow diagram. The second part provides the results relevant to the question for the review (Peters et al., 2020:2125). The reporting of the scoping review was guided by the standards of the PRISMA-ScR (Tricco et al., 2018:474-482). The scoping review results were presented as a map of the data extracted from the included papers in a tabular form.

2.3.1.2 *Methodology of the drafting of the strategy*

The researcher used the findings of Phase 1 and the outcome of a comprehensive literature review to draft a set of strategies to prevent the healthcare-associated spread of respiratory infections. A descriptive literature analysis was conducted through basic coding by categorising data. The categories and sub-categories of the scoping review were integrated with the findings of Phase 1 as drafted guidelines (Refer to Chapter Four). As the KAP theory and the HBM structured the findings of Phase 1, the researcher used the same theory and model to structure the drafted strategies. The drafted strategies were compiled to meet the criterion of the AGREE device (Brouwers et al., 2017:7). These aspects are solicited:

1. **Scope and purpose of the strategy**: The objective of the strategy and the target population are described in the preamble of the strategy.
2. **Stakeholder involvement in developing the strategy:** The target users of the strategy were defined in the preamble.
3. **The rigour of strategy development:** Systematic methods were used to search for evidence. A scoping review using the Joanna Briggs Institute methodological framework for scoping reviews was used to explore and analyse the literature. The findings of a cross-sectional study to determine the KAP of Ghanaian healthcare workers were integrated with the literature in the drafting of the strategy. It is briefly described in the preamble of the strategy.
4. **Clarity and presentation of the strategy:** The rationale and actions of the strategy were presented.
5. **Applicability of the strategy:** The strategies advise on how the actions can be put.

The editorial independence of the strategy: This aspect is not applicable as it discourses the potential competing interests of funding bodies. The researcher did not use funding from organisations to execute the research and develop the strategy.

2.3.2 Refinement of the strategy

The researcher involved healthcare manager participants in focus group discussions to refine the drafted strategies. A descriptive qualitative study was conducted. The study was descriptive, and the participants' input was used to refine strategies to prevent the healthcare-associated spread of respiratory infections (Polit & Beck, 2014:235).

2.3.2.1 *Research method*

A descriptive qualitative research approach was followed and focus group interviews were implemented to refine the proposed strategies to prevent the healthcare-associated spread of respiratory infections.

Focus group interviews are used by researchers in the social and behavioural sciences to explore phenomena and are accepted as a qualitative research methodology. The researcher aimed to refine the strategies to prevent the healthcare-associated spread of respiratory infections through the observations and opinions of groups of participants interacting during interviews. The group is 'focused' as it involves a collective activity, such as debating, talking to one another, asking questions of one another, and commenting on others' experiences and points of observation on a phenomenon. Data is generated resulting from discussion among participants to increase the depth of the inquiry and confirm aspects of the phenomenon assumed to be less accessible (Doody et al., 2013:1).

Being qualitative, it emphasises meaning rather than measurement and requires researchers to immerse themselves in the interviews. As members participate in the interviews, similarities and differences are emphasised, and it provides rich information about their range of perspectives and experiences. The researcher was the facilitator and used group dynamics and interaction to acquire data about each action related to the strategy. The researcher, as the primary facilitator of the focus group interviews, guided the interaction to ensure that the discussions remained focused on the refinement of the draft strategies to prevent the healthcare-associated spread of respiratory infections.

2.3.2.2 *Study population and sample*

The study population for this phase was the managers of the selected healthcare facilities. From each selected healthcare facility, the researcher purposively invited two managers to participate in refining the strategy. Purposive sampling is a non-probability sampling technique providing for the selection of information-rich cases that can provide information about a specific phenomenon and objective (Grove, 2017:345). The managers were deliberately involved to ensure that realistic strategies and actions were produced, and their involvement in the refinement might lead to better collaboration during future implementation. The sample comprised 10 healthcare managers (two from each healthcare facility).

The researcher approached the healthcare managers of the respective healthcare facilities for assistance in selecting potential manager participants for the focus group interviews. The selected participants were approached telephonically to determine their willingness, availability, and capacity to participate in the current study. A discussion with the co-facilitators of the interviews confirmed their willingness to assist the researcher with field notes during the focus group interviews. The researcher considered up to four focus group interviews during the initial planning of the proposed research, depending on how the research emerges, with 8-10 participants per focus group; however, after two focus group interviews, with five participants in each group, had been conducted, it was decidedly jointly with the study’s supervisors that further focus group discussions were unlikely to produce additional information. Only two focus group discussions were conducted. Each focus group comprised managers of the healthcare team.

2.3.2.3 *Research setting*

The research was conducted in five GHS Facilities in the Ashanti region, such as Kumasi South Hospital (regional hospital), Suntreso Government Hospital, Ejisu Government Hospital, Bekwai Municipal Hospital, and Nkawie Government Hospital. All the selected facilities provided care for COVID-19 patients during the pandemic. Although managers from five healthcare facilities were involved, the focus group interviews were conducted in two facilities from the five selected facilities. The managers from the other facilities would drive to the Bekwai Municipal Hospital and Kumasi South Hospital.

2.3.2.4 *Data collection*

The researcher conducted two focus group interviews to refine the strategy and actions to implement the strategy. The interaction between the members of the group encouraged them to express and clarify their observations about the strategy. The researcher assumed that rich, in-depth data could only emerge if she engaged in the interaction process by encouraging group members to express their views, ponder on the topic, and debate any differences constructively.

The discussions focused on the draft strategies formulated by the researcher, based on the results obtained during phase I of the research and a comprehensive literature review. The purpose of the focus groups was to encourage the participants to refine the strategy by commenting on the clarity, applicability, and feasibility of each strategy. Their input in re-formulating the strategy was appreciated.

2.3.2.5 *Preparing for the focus group interview*

The researcher prepared a draft set of strategies to prevent the healthcare-associated spread of respiratory infections from the findings in Phase 1 and the comprehensive literature review. The draft set of strategies is included in Chapter Five. With the permission of the management of the healthcare facilities, the researcher invited potential participants, explained the research to them, provided them with participant information leaflets (Appendix F), and provided them with adequate time to participate in the research. The researcher arranged a venue and time that would suit the participants of each discussion. It was a challenge to find such a venue and time as the participants were from various hospitals.

The researcher arranged a transportation allowance for all the participants to ease their burden of moving from their locations to the venue. Five focus group interview participants and co-facilitators were identified for Focus Group 1. They included the public health unit manager, a nurse manager, a mental health unit manager, a medical laboratory unit manager, and a paediatric unit manager. Focus Group 2 participants included a medical practitioner, a pharmacy manager, the public health laboratory manager, the Infection prevention and control (IPC) manager, and a senior professional nurse (unit manager). The deputy nurse manager's office at the Bekwai Municipal Hospital and the IPC manager's office at the Kumasi South Hospital were appropriate for privacy, minimum disturbance, and comfort to conduct the focus group interviews.

The researcher contacted the participants to confirm their willingness to participate and provided participants with the draft set of strategies, the participant information leaflet, and the informed consent form. These documents ensured informed consent and informed participants so they could make informed decisions whether they were interested in participating in focus group discussions (Appendix F). The researcher contacted the participants physically and by telephone calls before the data collection. All participants confirmed their willingness to participate. The researcher considered the flexibility of the proposed dates and times and the participants' busy schedules when she ensured that all focus group participants were aware of the estimated duration of each group session (one hour).

A PowerPoint presentation was prepared about the draft strategies for discussion during the focus group interview at healthcare facility one. The researcher confirmed the final arrangements with the healthcare managers and prepared herself mentally on the evening before each focus group interview. She reviewed the draft strategies and practised introducing the focus group interview. She confirmed the PowerPoint presentation for clarity and made sure all supporting documents and seating preparations (pens, snacks, and transportation allowances) were ready (Redmond & Curtis, 2009:60).

The researcher arrived at the venue one hour before the scheduled interview to prepare the venue. She prepared the venue for comfort and privacy to set the tone for open group discussions and debates. Enough chairs were arranged as a ‘horseshoe’. Air-conditioning was set in advance to provide for a comfortable room temperature. A ‘Do not disturb’ sign was positioned on the door to ensure minimal disturbance during the interview. A copy of the informed consent and participation leaflet and, a hard copy of the drafted set of strategies, and a pen were also positioned at each seat. Equipment, such as the projector and gadgets for audio recording, were tested.

2.3.2.6 *Facilitating a trial focus group interview*

A trial focus group interview was conducted at a private healthcare facility in preparation for the data collection. Approval was obtained from the hospital administrator. It was confirmed that the session would serve as a non-research trial. The researcher attempted to simulate the session closely to the research focus group interviews. She planned a replica of the processes at the two facilities. Because of the lessons learnt in conducting the trial focus group interview, the researcher adjusted and refined the process followed during the data collection. The duration of the session was maintained. Participants preferred a hard copy of the PowerPoint presentation to make notes instead of the complete set of draft strategies.

Hard copies of the PowerPoint presentation were, therefore, provided to participants of the research focus group interviews as suggested during the pre-test focus group interview. A request for a structured hard copy from the co-facilitator to make notes was noted, and a document was designed and used accordingly. The researcher's exposure to conducting a focus group and positive feedback from participants of the trial focus group interview strengthened the researcher’s confidence in facilitating the subsequent focus group interviews at the two facilities.

2.3.2.7 *Facilitating Focus Group Interview 1*

The researcher was warmly and friendlily welcomed by the managers on the day of the focus group interview. After confirmation of all participants' attendance, the researcher introduced herself and welcomed all participants. The focus group participants were unacquainted with each other; therefore, introducing the participants was necessary. A brief introduction of the study and the purpose of the focus group interview were presented. Informed consent was discussed, and the documents were signed and handed to the researcher. A demographic information leaflet was also provided to participants to complete. Opportunity for questions was provided, and the group set rules, discussed, and agreed.

The role of the co-facilitator was clarified, and the process of refinement of the strategy was explained. The researcher used a co-facilitator to manage logistic arrangements, write field notes, and ensure that the discussions were audio-recorded with the participants' permission. The researcher facilitated the discussion. She ensured that all participants felt comfortable and felt free to participate. She did not allow them to interrupt the discussion and acknowledged the contribution of everyone. A PowerPoint presentation was used to facilitate the discussion and revise and refine strategies with actions individually. Participants were provided with a hard copy of the PowerPoint presentation and were encouraged to make notes on the document during the discussion.

Each strategy with actions was analysed and debated comprehensively. The participants evaluated every draft strategy, rephrased it, removed it if it was not applicable, and appreciated it when it appeared appropriate. All group members agreed on changes before moving to the next strategy. The participants remained focused and provided inputs and suggestions for changes. Some participants engaged more actively in the discussions than others, but all members provided inputs at some stage of the group session. The researcher briefly summarised the discussion to conclude the session and allowed opportunities for questions. All participants were thanked for participating and requested to leave their documents with notes on their desks when the meeting ended. The duration of the session was 57 minutes. An appreciation was sent to all participants following the meeting through phone calls and emails.

The researcher prepared a new, refined set of strategies for the focus group at the next facility two days later. The refined strategy set acknowledged the input of Focus Group 1. The researcher considered inputs from the focus group interview and the notes made by participants during the Focus Group Interview 1. Changes were made as suggested by the group, grammar errors were corrected, some words were rephrased, and additional actions were added. Field notes, compiled by the co-facilitator, were considered.

2.3.2.8 *Facilitating Focus Group Interview 2*

Permission to conduct focus group interviews was obtained from the healthcare facility before the commencement of Phase 1 of the study (Appendix B). The participants were approached, such as during the preparation phase of Focus Group 1. The refined strategies were discussed and debated individually, and changes were made from the participants' inputs. This focus group discussion lasted one hour. A final set of strategies to prevent the healthcare-associated spread of respiratory infections was formulated by implementing the recommendations of the focus group participants.

2.3.2.9 *Managing field notes*

The field notes were a primary data source for data analysis. A co-facilitator took detailed notes of the inputs of various participants during the focus group interviews. Focus group participants were provided with copies of the PowerPoint presentation and were encouraged to make notes and comments during the discussions. They were requested to hand their notes to the researcher upon completion of the focus group discussion.

Notes were taken on the reformulation, adding, or removing statements from the draft set of strategies. The researcher revised the field notes and clarified that the notes were legible and that they made sense. All notes were anonymised by removing the participants' names from the notes. A summary was prepared by combining the researcher's, the co-facilitators, and the focus group participants' notes into one document to serve as a baseline database for the data analysis after the completion of Focus Group Interview 1. A second summary was prepared following Focus Group Interview 2 (Appendix H).

2.3.2.10 *Data organisation and analysis*

Group dynamics should be considered when analysing the data to ensure accurate interpretations of individual statements and observations within the broader influence of other focus group participants (Gill et al. 2008:294). It is recommended to analyse data as soon as possible after each focus group discussion to prevent data from being influenced or distorted by subsequent focus group interviews (Krueger & Casey, 2015:232). Field notes are important data sources (Krueger & Casey, 2015:235). Note-based data analysis was used in the current study using field notes as a primary source to refine the strategy to prevent healthcare-associated respiratory infections.

Data collection and analysis are simultaneous processes (Krueger & Casey, 2015:223). The researcher analysed the data by suggesting changes and statements during the debates among the focus group participants to conclude with final statements as refined statements per strategy. She reflected on views, enquired for more opinions, and opened debates when opinions changed.

The data analysis of Focus Group Interview 1 proceeded on the evening after the focus group interview. The researcher perused the field notes to obtain an overview of the suggested refined statements from the participants' inputs. The researcher compared and considered the notes of the co-facilitator, the participants, and her own. Most notes were similar, presenting the concluded refined statements agreed by the participants. The researcher provided extra attention to any notes different from the agreed statements. She considered the unique group dynamics and individual contributions within the group and drafted a refined set of strategies for consideration and further refinement during Focus Group Interview 2. She provided copies of the revised strategy to participants of Focus Group 2. The same process followed Focus Group Interview 2, and a final set of strategies to prevent the healthcare-associated spread of respiratory infections were formulated. The focus group interview data were much simpler, concise, and focused on the topic. Minimum new data were collected. As proof of the refinement of the strategy, an audit trail was kept. The input of each focus group was considered on the audit trail. The result of the analysis was a final set of strategies to prevent the healthcare-associated spread of respiratory infections.

2.3.2.11 *Ensuring the trustworthiness of the findings*

The **credibility** of findings refers to the 'truth value' of the data and how the researcher interprets it (Polit & Beck, 2018:295). The researcher collected the data over two focus group interviews with participants from five healthcare services. She actively involved the participants in revising the strategy and associated actions. Discussions continued until a consensus was reached.

Dependability refers to the stability of data over time and conditions. It is similar to the concept of reliability in quantitative research (Polit & Beck, 2018:295). The researcher comprehensively described the data collection and analysis processes, providing others with detailed information that served as an audit trail.

Confirmability is how researchers try not to influence data interpretation (Polit & Beck, 2018:295). Qualitative researchers ensure that the findings represent the information the participants provide (Brown et al., 2015:831). The participants refined the strategy and associated actions during the interviews. Their input was, therefore, reflected in the refined set of strategies and activities and not that of the researcher.

The **transferability** of findings refers to the extent to which it has "applicability in other settings or groups" (Polit & Beck, 2018:295). The researcher thoroughly describes the sampling process, the sample demographics, and the study context.

Authenticity refers to the extent to which the researcher "fairly and faithfully shows a range of different realities" (Polit & Beck, 2018:295). The researcher described the processes, so others acquired an understanding of the participants' input in refining the strategy.

2.4 Ethical considerations of the study

The Research Ethics Committee of the Faculty of Health Sciences at the University of Pretoria approved the proposal (357/2022) (Appendix A). The ethical clearance letter was sent to the GHS Ashanti Region Health Directorate to pursue permission to conduct the study. The researcher also obtained permission from the management of the selected healthcare facilities before sampling commenced (Appendix B).

The principles of the Belmont Report were also considered. She respected the respondents' right to freedom from harm and discomfort, to protect them from exploitation fair treatment, voluntary participation in the study, to withdraw without negative consequences, and to the confidential treatment of information (Polit & Beck, 2018:79-84). Please refer to the description of data collection for both phases for a description of applying the ethical principles in the study's methodology.

2.5 Chapter summary

The researcher provides a detailed description of the paradigmatic perspective, theoretical framework, and the research methodology used to conduct the study. The KAP theory and the HBM are discussed as models for studying human behaviour and attitudes/beliefs. The research methodology, including the design, setting, population, sampling, data collection, and data analysis, are discussed. Further elaboration on the claim about rigour, trustworthiness, and ethical consideration guiding the study is outlined. Chapter Three presents the findings of Phase 1 of the study.

CHAPTER THREE
PRESENTATION OF FINDINGS OF PHASE 1 OF THE STUDY

3.1. Introduction

This chapter presents the findings of the healthcare workers' knowledge, attitudes, and practices towards COVID-19. In the previous chapter, the research methodology is discussed. Data analysis was conducted by using the SPSS Version 23.

The demographic characteristics are compared with the level of KAP scores using the Chi-square test. A 95% confidence interval (CI) was used to quantify the strength of the association between sociodemographic characteristics and KAP scores of healthcare workers. The level of significance was set at $P < 0.05$ (two-sided).

3.2 Study findings

3.2.1 Demographic characteristics of participants

The number of healthcare worker participants from each facility and their mean age, gender distribution, academic qualification, specialisation, years of experience, and source of information regarding COVID-19 are presented in Table 3.1.

Table 3.1: Demographic characteristics of 373 healthcare workers in the study

Characteristics	No. of respondents	Percentage (%)
Age		**Mean**:30.96, **SD**:6.25
• 20-39	327	87.7
• 40-49	43	11.5
• ≥50	3	0.80

Characteristics	No. of respondents	Percentage (%)
Gender		
• Male	102	27.34
• Female	271	72.66
Marital Status		
• Married	162	43.43
• Single	205	54.96
• Separated	6	1.61
Place of work		
• Bekwai Municipal Hospital	75	20.11
• Ejisu Government Hospital	73	19.57
• Kumasi South Hospital	75	20.11
• Nkawie Government Hospital	76	20.37
• Suntreso Government Hospital	74	19.84
Occupation/Specialisation		
• Doctor	17	4.6
• Nurse	201	53.9
• Midwife	82	21.9
• Allied healthcare professional	56	15.0
• Maintenance staff	17	4.6
Duration of experience		
• Less than two years	127	34.05

Characteristics	No. of respondents	Percentage (%)
• 2-5 years	143	38.3
• Greater than 5 years	103	27.6
Religion		
• Christianity	334	89.54
• Islam	38	10.19
• Traditional	1	0.27
Highest level of education		
• Masters	14	3.75
• Bachelor	126	33.78
• Diploma	191	51.21
• Certificate	42	11.26

Table 3.1 illustrates the main sociodemographic characteristics of the study participants. Most participants were female, n=271 (72.66%), with a mean age of 30.96 (SD:6.25) years. 54.96% of the participants were single, n=162(43.43%) were married, and only 1.61% were separated. Most participants who completed the questionnaire were from Nkawie Government Hospital n=76 (20.37%), with Ejisu Government Hospital recording the lowest number, indicating n=73(19.57%). Most of the participants were nurses n=201 (53.9%); 34% of the healthcare workers had less than two years of working experience, and a majority (89.54%, n=334) were Christian. Most participants held diplomas (51.21%, n=191).

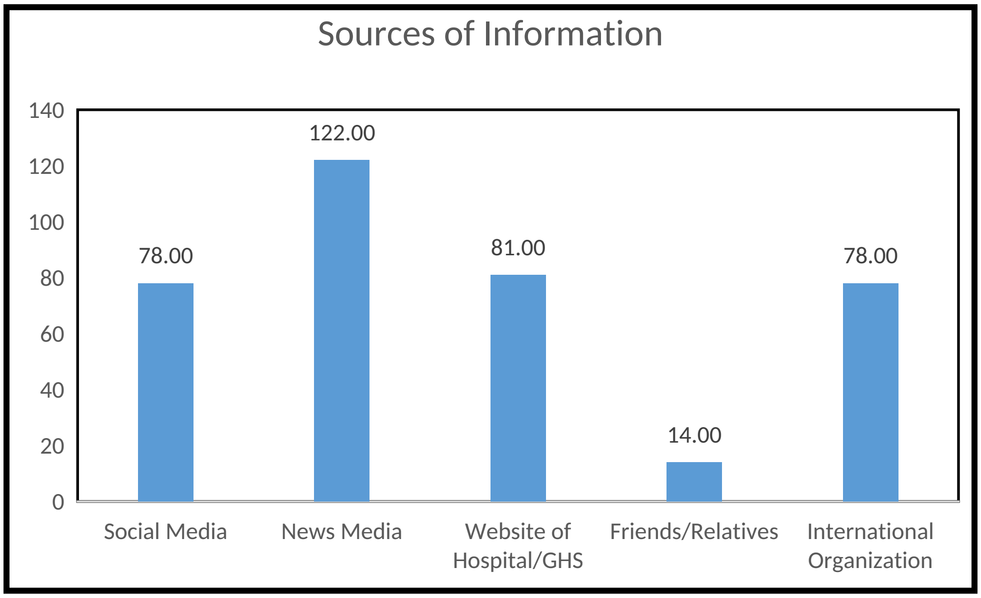


Figure 3.1: Healthcare workers source of information on COVID-19

Most healthcare workers received information regarding COVID-19 from the news media (32.7%), n=122, and 21.7% reported they obtained their information from the website of their hospital or the GHS. Others remarked on social media (20.9%) n=78 and international organisations, such as the WHO (20.9%), n=78. Few reported receiving information from friends and relatives (3.8%) n=14. The study findings regarding healthcare workers obtaining information from social media, news media, and friends are not according to a study in Ethiopia where 79% of the HCWs received information from social media, 52% from the news media, and 17.3% from colleagues (Bitew et al., 2021:4).

3.2.2 Findings relating to the first research question

The first research question is:

1) What is known about the knowledge, attitudes, and preventive practices towards COVID-19 among healthcare workers in the Ashanti region of Ghana?

The first research objective was:

To describe the knowledge-level of healthcare workers regarding COVID-19 in the Ashanti region, Ghana.

Table 3.2: Knowledge category

	Frequency	Percentage	Cumulative percentage
Limited knowledge	12	3.2	3.2
Good knowledge	320	85.8	89.0
Excellent knowledge	41	11.0	100.0
Total	373	100.0	

Table 3.3: Healthcare workers' responses to the knowledge questions

NO	Statement	Correct responses %
K1	A virus causes COVID-19.	99.2 (n=370) agree/strongly agree
K2	COVID-19 is new and has never been recorded before 2019.	82.9 (n=309) agree/strongly agree
K3	The incubation period of the disease may be up to 14 days.	94.1 (n=351) agree/strongly agree
K4	The main symptoms of COVID-19 are cough, fever, headache, tiredness, and difficulty breathing.	96.8 (n=361) agree/strongly agree
K5	A person may have COVID-19 yet display no symptoms.	91.2 (n=340) agree/strongly agree

NO	Statement	Correct responses %
K6	COVID-19 is transmitted through respiratory droplets and contact with infected persons.	97.9 (n=365) agree/strongly agree
K7	COVID-19 transmission by animal products is unknown.	63.0 (n=235) agree/strongly agree
K8	COVID-19 is transmitted mainly through the air.	7.5 (n=28) disagree/strongly disagree
K9	The disease transmission from asymptomatic persons is possible.	92.2 (n=344) agree/strongly agree
K10	Pets may be infected, and transmission from pets is unknown.	59.5 (n=222) agree/strongly agree
K11	The main method of diagnosis is the rRT-PCR test.	79.6 (n=297) agree/strongly agree
K12	The main method of diagnosis is the antibody kit.	13.9 (n=52) agree/strongly agree
K13	COVID-19 can be treated.	93 (n=347) agree/strongly agree
K14	Suspected persons with COVID-19 must go into self-isolation for 14 days.	98.4 (n=367) agree/strongly agree
K15	Confirmed cases of COVID-19 are often quarantined.	97.3 (n=363) agree/strongly agree
K16	Antibiotics are the first line of treatment.	10.7 (n=40) disagree/strongly disagree
K17	Persons with fundamental condition disease are at increased risk of severe cases and death.	95.7 (n=357) agree/strongly agree
K18	COVID-19 can be prevented by regular wearing of face masks.	93.8 (n=350) agree/strongly agree
K19	COVID-19 can be prevented by frequent washing of hands with soap and water.	96.5 (n=360) agree/strongly agree
K20	Using alcohol-based hand sanitisers prevents COVID-19.	

NO	Statement	Correct responses %
		93.0 (n=347) agree/strongly agree
K21	70% alcohol kills the virus.	72.1 (n=269) agree/strongly agree
K22	Chlorhexidine kills the virus.	19.3 (n=72) disagree/strongly disagree
K23	keeping a distance of at least 1 metre (3 feet) prevents contracting the disease.	91.4 (n=341) agree/strongly agree
K24	Maintaining even a greater distance between yourself and others when indoors can prevent contracting COVID-19.	86.6 (n=323) agree/strongly agree
K25	There is a vaccine for COVID-19.	97.1 (n=362) agree/strongly agree

The participants who scored 80%-100% on the knowledge questions were considered having very good knowledge, 60%-79% had good knowledge, and a score less than 60% with limited knowledge.

Findings from the study revealed that 11% had excellent knowledge, and a few (3.2%) had limited knowledge of COVID-19. They obtained less than 60% on the knowledge questions. Most participants, indicating 85.8%, had good knowledge of COVID-19. The result is comparable with three studies conducted in Nigeria, where the healthcare worker participants' knowledge of COVID-19 was 88.75%, 83.7%, and 82.4% respectively (Ejeh et al., 2020:1; Tisga-Ahmed et al., 2021:1; Abene et al., 2021:1). Two studies were also conducted in Ethiopia of which the researchers recorded good knowledge of COVID-19 among their healthcare worker participants (Jemal et al., 2021:4; Alemu et al., 2022:1).

The study findings compared well with results of studies conducted in Pakistan, Nigeria, and Nepal, recording that 75.5%, 78.6%, and 76% of the healthcare worker participants had good knowledge of COVID-19, respectively (Salman et al., 2020:1; Ayinde et al., 2020:10; Tamang et al., 2020:5). The findings of the present study about good knowledge of COVID-19 were low compared to three studies conducted in Pakistan. The studies reported 94.8%, 93.2%, and 90% of good knowledge of their healthcare worker participants, respectively (Malik et al., 2020:6; Saqlain et al., 2020:1; Hussain et al., 2021:444).

Another survey conducted in Vietnam recorded that 91.3% of their healthcare worker participants had good knowledge of COVID-19 (Tien et al., 2021:1). Conversely, the percentage of healthcare worker participants of this study who obtained good marks for their understanding of COVID-19 is much higher than that of studies conducted in Thailand, Nepal, and Ethiopia. The three studies recorded that 58%, 45.7%, and 40.5% of the healthcare worker participants displayed good knowledge of COVID-19, respectively (Kunno et al., 2022:3; Ghimire et al., 2020:2; Fetansa et al., 2021:3).

The differences in the knowledge level of the participants in the mentioned studies may relate to most healthcare workers having had relevant training on COVID-19, whereas others received no training before the studies were conducted.

The second research objective was:

To describe the attitude of healthcare workers towards COVID-19 in the Ashanti region, Ghana.

Table 3.4: Attitude category

	Frequency	Percentage	Cumulative percentage
Poor attitude	83	22.3	22.3

Good attitude	211	56.6	78.9
Excellent attitude	79	21.1	100.0
Total	373	100.0	

Table 3.5: Healthcare workers' responses to the attitude questions

NO.	Statements	Correct responses %
A1	I fear working in a hospital when COVID-19 patients are admitted.	38.1 (n=142) disagree/strongly disagree
A2	I fear caring for COVID-19 patients.	42.2 (n=158) disagree/strongly disagree
A3	I believe that I may transmit the disease to my family.	78.0 (n=291) agree/strongly agree
A4	Healthcare workers become infected at a high rate, even with adequate protection.	10.2 (n=38) disagree/strongly disagree
A5	I must report to my facility if I become infected with COVID-19.	93.8 (n=350) agree/strongly agree
A6	I must stay home and self-isolate when presented with minor symptoms, such as cough, headache, and mild fever, until I recover.	97.9 (n=365) agree/strongly agree
A7	I should be responsible for ensuring that people around me follow good respiratory hygiene, use of face mask, proper disposal of used tissue and social distancing.	98.4 (n=367) agree/strongly agree
A8	Health education programmes are effective for better control of COVID-19.	98.4 (n=367) agree/strongly agree
A9	The COVID-19 Pandemic will be successfully controlled by the current guidelines and vaccine.	87.9 (n=328) agree/strongly agree

The participants who scored 80%-100% on the attitude questions were considered having an excellent attitude towards COVID-19, 60%-79% were supposed to have a good attitude towards COVID-19, and a score less than 60% was considered a poor attitude towards COVID-19.

The study revealed that 56.6% of the healthcare worker participants had good attitudes towards COVID-19. This finding compares well with that of two studies conducted in Nepal, where 53% and 54% of good attitudes were recorded (Limbu et al., 2020:1; Tamang et al., 2020:1). In another survey conducted in India, over 50% of the healthcare worker participants had good attitudes towards COVID-19 (Kumar et al., 2021:3). The finding is low compared to three studies conducted in Ethiopia. Their findings indicated that 84%, 85%, and 84.2% of the participants respectively portrayed good attitudes towards COVID-19 (Gopalakrishnan et al., 2021:4; Alemu et al., 2022:4; Yesse et al., 2021:7).

The difference in the healthcare worker participants' attitudes could be owing to variances in the study setting, the timeframe of the study, and the cut-off points for the attitude scores.

The third research objective was:

To describe the practices of healthcare workers towards preventing the spread of COVID -19 in the Ashanti region, Ghana.

Table 3.6: Practice categories

	Frequency	**Percentage**	**Cumulative percentage**
Poor practices	92	24.7	24.7
Acceptable practices	98	26.3	51.0
Excellent practices	183	49.0	100.0

	Frequency	Percentage	Cumulative percentage
Total	373	100.0	

Table 3.7: Healthcare workers' responses to the practice questions

		Responses		
NO.	Statements	YES (%)	NO (%)	Lack of equipment/facility (%)
P1	Do you have access to the PPE that protects you for the appropriate setting and context?	59 N=220	23.3 N=87	17.7 N=66
P2	Have you been trained on donning and discarding of PPEs?	70 N=261	27.3 N=102	2.7 N=10
P3	Do you use PPE when you visit a susceptible patient?	78.3 N=292	13.7 N=51	8 N=30
P4	Do you wear a surgical face mask when doing the usual physical examination?	73.5 N=274	22.5 N=84	4 N=15
P5	Do you wear the N95 face mask when doing aerosol-generating procedures?	57.1 N=213	30.3 N=113	12.6 N=47
P6	Do you test the N95 mask before using it?	42.9 N=160	8.6 N=32	48.5 N=181
P7	Do you dispose of your gloves and aprons after a single use on each patient contact?	79.1 N=295	4.3 N=16	16.6 N=62
P8	Do you use your fluid-repellent surgical mask and eye protection for a session of work or other than a single patient?	56.0 N=209	30.8 N=115	13.2 N=49
P9		76.9	15.3	7.8

		Responses		
	Do you wear your gowns or coveralls for a work session in higher-risk areas?	N=287	N=57	N=29
P10	Do you disinfect linen/bedding used by patients infected with COVID-19 before sending them to the laundry?	90.3 N=337	9.4 N=35	0.3 N=1
P11	Do you wash your hands with soap and running water after a physical encounter with patients?	96.2 N=359	3.8 N=14	
P12	Do you wash your hands for at least 20 seconds?	90.9 N=339	9.1 N=34	
P13	Do you use a paper towel or towel to turn off the faucet after washing your hands?	79.9 N=298	17.2 N=64	2.9 N=11
P14	Do you regularly clean your hands with alcohol-based sanitiser?	94.9 N=354	4.6 N=17	0.5 N=2
P15	Are you able to maintain at least 1 metre (3 feet) distance between yourself and others?	81 N=302	18.2 N=68	0.8 N=3
P16	Are you able to isolate susceptible patients as soon as they arrive?	83.9 N=313	14.2 N=53	1.9 N=7
P17	Do you recommend home isolation to anyone who encounters a patient infected with COVID-19?	80.4 N=300	19.6 N=73	

Participants who scored 80%-100% on the questions regarding their practices towards preventing the spread of COVID-19 were considered having excellent practices; 60%-79% were considered acceptable practices, and scores less than 60% were considered poor practices. Less than 50% of the healthcare worker participants had excellent practices towards COVID-19 prevention in the Ashanti Region. In a similar study in Uganda, only 37% of the healthcare worker participants had good practices towards preventing the spread of the coronavirus disease (Kamacooko et al., 2021:1).

Much higher scores were identified in studies in China, Saudi Arabia, and Yemen, where 89.7%, 82%, and 87.7% of the healthcare worker participants had good practices towards COVID-19 prevention (Zhang et al., 2020:186; Bashir et al., 2021:5; Alrubaiee et al., 2020:1). In the current study, most of the healthcare worker participants who exhibited poor preventive practices, indicated that a lack of PPE and few isolation facilities in the Ashanti region were to be blamed.

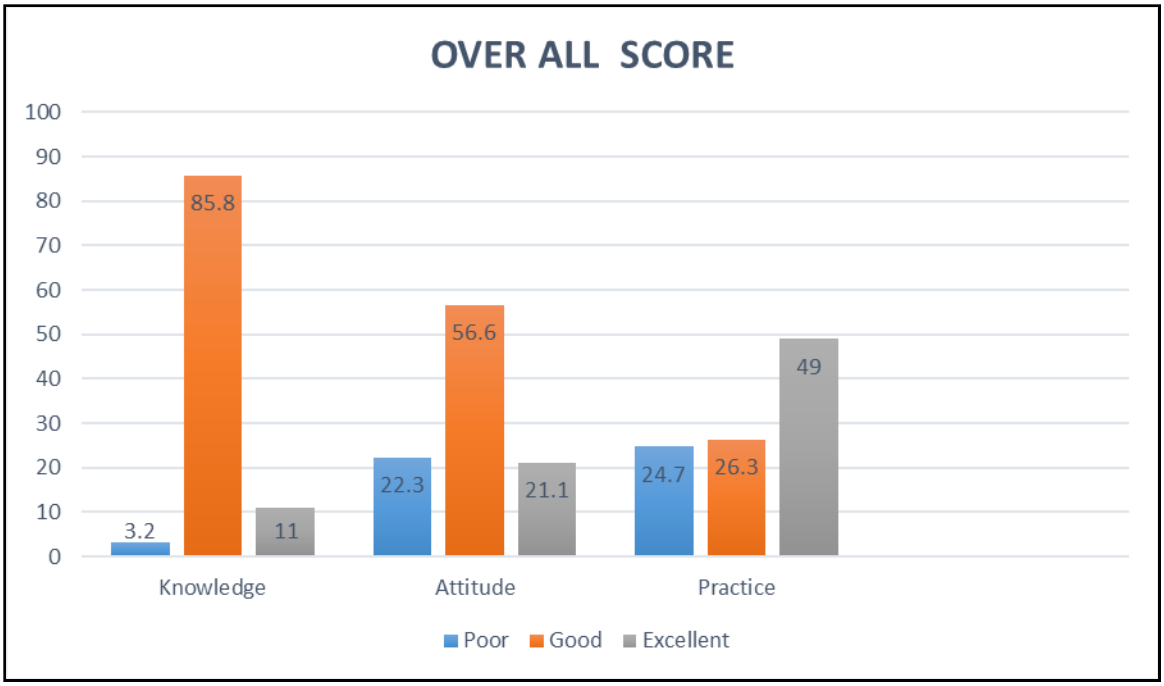


Figure 3.2: The KAP Score of COVID-19 among healthcare worker participants in Ashanti

The fourth research objective was:

To determine the relationship between the healthcare workers' gender, age, religion, marital status, highest level of education, duration of the experience at work, occupation (specialisation) and place of work and their knowledge, attitudes, and practices regarding COVID-19.

Table 3.8: Knowledge of COVID-19 among healthcare worker participants in the Ashanti region by demographic characteristics

			Knowledge score				
Variables			Limited knowledge	Good knowledge	Excellent knowledge		
		F (%)	N (%)	N (%)	N (%)	d/f	Value
Age	20-39	327 (87.7)	11 (2.9)	284 (76.1)	32 (8.6)	1	0.04
	40-49	43 (11.5)	1 (0.3)	34 (9.1)	8 (2.1)		
	≥50	3 (0.8)	0 (0.0)	2 (0.54)	1 (0.3)		
Gender	Male	102 (27.3)	3 (0.8)	86 (23.1)	13 (3.5)	1	0.515
	Female	271 (72.6)	9 (2.4)	234 (62.7)	28 (7.5)		
Marital status	Married	162 (43.4)	3 (0.8)	140 (37.5)	19 (5.1)	1	0.087
	Single	205 (54.9)	9 (2.4)	176 (47.2)	20 (5.4)		
	Separated	6 (1.61)	0 (0.0)	4 (1.1)	2 (0.5)		
		75 (20.1)	1 (0.3)	66 (17.6)	8 (2.1)	8	0.795

		Knowledge score					
Place of work	Bekwai Municipal Hospital						
	Ejisu Government Hospital	73 (19.6)	3 (0.8)	60 (16.1)	10 (2.7)		
	Kumasi South Hospital	75 (20.1)	4 (1.0)	65 (17.4)	6 (1.6)		
	Nkawie Government Hospital	76 (20.4)	3 (0.8)	65 (17.4)	8 (2.1)		
	Suntreso Government Hospital	74 (19.8)	1 (0.3)	64 (17.1)	9 (2.4)		
Occupation / Specialisation	Doctor	17 (4.6)	0 (0.00)	12 (3.2)	5 (1.3)	8	0.098
	Nurse	201 (53.9)	9 (2.4)	175 (49.6)	7 (1.8)		
	Midwife	82 (21.9)	1 (0.3)	73 (19.6)	8 (2.8)		
	Allied healthcare professional	56 (15.0)	1 (0.3)	45 (12.1)	10 (2.7)		
	Maintenance staff	17 (4.6)	1 (0.3)	15 (4.0)	1 (0.3)		
Duration of experience	Less than two years	127 (34.1)	5 (1.3)	108 (28.9)	14 (3.7)	1	0.293
	2-5 years	143 (38.3)	5 (1.3)	126 (33.7)	12 (3.2)		
		103 (27.6)	2 (0.5)	86 (23.0)	15 (4.0)		

	Knowledge score						
	Greater than five years						
Religion	Christianity	334 (89.5)	12 (3.2)	291 (78.0)	31 (8.3)	1	0.002
	Islam	38 (10.2)	0	28 (7.5)	10 (2.7)		
	Traditional	1 (0.3)	0	1 (0.3)	0		
Highest level of education	Masters	14 (3.8)	0	12 (3.2)	2 (0.5)	1	0.299
	Bachelor	126 (33.8)	5 (1.3)	103 (27.6)	18 (4.8)		
	Diploma	191 (51.2)	6 (1.6)	168 (45.0)	17 (4.6)		
	Certificate	42 (11.3)	1 (0.3)	37 (10.0)	4 (1.0)		
Source of information	Social media	78 (20.9)	5 (1.3)	67 (17.9)	6 (1.6)	8	0.105
	News media	122 (32.7)	3 (0.8)	107 (28.7)	12 (3.2)		
	Website of hospital/GHS	81 (21.7)	0	70 (18.7)	11 (2.9)		
	Friends/ Relatives	14 (3.8)	2 (0.5)	11 (2.9)	14 (3.7)		
	International health organization	78 (20.9)	2 (0.5)	65 (17.4)	78 (20.9)		

In the multivariate analysis, age and religious affiliation of the healthcare worker participants were strongly associated with good knowledge of COVID-19 (p=0.004) (p=0.002). This finding follows a study in Nigeria, where the knowledge score among the religious group was (0.019) (Ejeh et al., 2020:3). Another study in Ethiopia established that the age of the healthcare worker participants was also a factor associated with their knowledge level regarding the coronavirus disease (Bitew et al., 2021:4). Although some studies reported place of work, level of education, specialisation and, source of information having a solid association with healthcare worker participants' knowledge level regarding COVID-19 (Kassie et al., 2020:9; Yesse et al., 2021:4), there was no significantly statistically association between marital status, place of work, occupation/specialisation, duration of experience, source of information of the healthcare worker participants and their knowledge level of COVID-19 in this study.

Table 3.9: Attitude of healthcare worker participants towards COVID-19 by demographic characteristics

Variables	Attitude score						
			Poor attitude	Good attitude	Excellent attitude		
		F (%)	N (%)	N (%)	N (%)	d/f	Value
Age	20-39	327 (87.7)	77 (20.6)	181 (48.5)	69 (18.5)	4	0.361
	40-49	43 (11.5)	6 (1.6)	27 (7.2)	10 (2.7)		
	≥50	3 (0.8)	0 (0.0)	3 (0.8)	0 (0.0)		
Gender	Male	102 (27.3)	20 (5.4)	59 (15.8)	23 (6.2)	1	0.471
	Female	271 (72.6)	63 (16.9)	152 (40.8)	56 (15.0)		
Marital status	Married	162 (43.4)	30 (8.0)	88 (23.6)	44 (11.8)	1	0.008
	Single	205 (55.0)	52 (13.9)	120 (32.2)	33 (8.8)		
	Separated	6 (1.6)	1 (0.3)	3 (0.8)	2 (0.5)		
Place of work	Bekwai Municipal Hospital	75 (20.1)	14 (3.7)	38 (10.2)	23 (6.2)	8	0.57
	Ejisu Government Hospital	73 (19.6)	15 (4.0)	41 (11.0)	17 (4.6)		
	Kumasi South	75 (20.11)	19 (5.1)	37 (9.9)	19 (5.1)		

Variables	Attitude score						
			Poor attitude	Good attitude	Excellent attitude		
	Hospital						
	Nkawie Government Hospital	76 (20.4)	13 (3.5)	51 (13.7)	12 (3.2)		
	Suntreso Government Hospital	74 (19.8)	22 (5.9)	44 (11.8)	8 (2.8)		
Occupation/ Specialisation	Doctor	17 (4.6)	1 (0.3)	10 (2.7)	6 (1.6)	8	0.336
	Nurse	201 (53.9)	47 (12.6)	116 (31.0)	38 (10.1)		
	Midwife	82 (21.9)	16 (4.3)	45 (12.1)	21 (5.6)		
	Allied healthcare professional	56 (15.0)	12 (3.2)	33 (8.8)	11 (2.9)		
	Maintenance staff	17 (4.6)	7 (1.8)	7 (1.8)	3 (0.8)		
Duration of	Less than	127 (34.1)	32 (8.6)	77 (20.6)	18 (4.8)	1	0.03

Variables	Attitude score						
			Poor attitude	Good attitude	Excellent attitude		
Experience	Two years						
	2-5 years	143 (38.3)	34 (9.1)	81 (21.7)	28 (7.5)		
	Greater than 5 years	103 (27.6)	17 (4.6)	53 (14.2)	33 (8.8)		
Religion	Christianity	334 (89.5)	73 (19.6)	188 (50.4)	73 (19.6)	1	0.378
	Islam	38 (10.2)	10 (2.7)	22 (5.9)	6 (1.6)		
	Traditional	1 (0.3)	0	6 (1.6)	0		
Highest level of education	Masters	14 (3.8)	1 (0.3)	7 (1.8)	6 (1.6)	6	0.369
	Bachelor	126 (33.8)	25 (6.7)	73 (19.6)	28 (7.5)		
	Diploma	191 (51.2)	45 (12.1)	109 (29.2)	37 (9.9)		
	Certificate	42 (11.3)	12 (3.2)	22 (5.9)	8 (2.1)		
Source of information	Social media	78 (20.9)	18 (4.8)	44 (11.8)	16 (4.3)	8	0.94
	News media	122 (32.7)	36 (9.7)	57 (15.3)	29 (7.8)		
		81 (21.7)	9 (2.4)	55 (14.7)	17 (4.6)		

Variables	**Attitude score**						
			Poor attitude	Good attitude	Excellent attitude		
	Website of hospital /GHS						
	Friends / relative	14 (3.8)	4 (1.1)	8 (2.8)	2 (0.5)		
	International health organization	78 (20.9)	16 (4.3)	47 (12.6)	15 (4.0)		

Healthcare worker participants with working experience of two years and above had good attitudes towards COVID-19 (p=0.03). There was no significant relation between the healthcare worker participants' age, place of work, occupation/specialisation, level of education, source of information, and attitude towards COVID-19. A significant statistical association between healthcare worker participants and their marital status exists (p=0.008). Excellent attitude regarding COVID-19 was established among married healthcare worker participants.

Table 3.10: Practice of healthcare worker participants towards preventing the spread of COVID-19 infections by demographic characteristics

Characteristics	**Practice score**						
			Poor practices	Acceptable practices	Excellent practices		
		F (%)	N (%)	N (%)	N (%)	d/f	Value
Age	20-39	327 (87.7)	82 (22.0)	93 (24.9)	152 (40.8)	4	0.037
	40-49	43 (11.5)	9 (2.4)	5 (1.3)	29 (7.8)		
	≥50	3 (0.8)	1 (0.3)	0 (0.0)	2 (0.5)		
Gender	Male	102 (27.3)	15 (4.0)	27 (7.2)	60 (16.1)	1	0.005
	Female	271 (72.6)	77 (20.6)	71 (19.0)	123 (33.0)		
Marital status	Married	162 (43.4)	43 (11.5)	36 (9.7)	83 (22.3)	4	0.053
	Single	205 (55.0)	49 (13.1)	62 (16.6)	94 (25.2)		
	Separated	6 (1.61)	0 (0.0)	0 (0.0)	6 (1.6)		
Place of work	Bekwai Municipal Hospital	75 (20.1)	7 (1.9)	14 (3.8)	44 (11.8)	8	0.096
	Ejisu Government Hospital	73 (19.6)	16 (4.3)	15 (4.0)	42 (11.2)		
	Kumasi South Hospital	75 (20.1)	17 (4.6)	23 (6.2)	35 (9.4)		
	Nkawie Government Hospital	76 (20.4)	20 (5.4)	19 (5.1)	37 (9.9)		
		74 (19.8)	22 (5.9)	37 (9.9)	25 (6.7)		

Characteristics	Practice score						
	Suntreso Government Hospital						
Occupation / Specialisation	Doctor	17 (4.6)	2 (0.5)	3 (0.8)	12 (3.2)	8	0.050
	Nurse	201 (53.9)	57 (15.2)	56 (17.0)	88 (23.6)		
	Midwife	82 (22.0)	19 (5.1)	22 (5.9)	41 (11.0)		
	Allied healthcare professional	56 (15.0)	8 (2.1)	11 (2.9)	37 (9.9)		
	Maintenance staff	17 (4.6)	6 (1.6)	6 (1.6)	5 (1.3)		
Duration of experience	Less than two years	127 (34.1)	37 (9.9)	31 (8.3)	59 (15.8)	1	0.429
	2-5 years	143 (38.3)	29 (7.8)	42 (11.3)	72 (19.3)		
	Greater than five years	103 (27.6)	26 (7.0)	25 (6.7)	52 (13.9)		
Religion	Christianity	334 (89.5)	88 (23.6)	86 (23.0)	160(42.9)	1	0.068
	Islam	38 (10.2)	4 (1.1)	11 (2.9)	23 (6.1)		
	Traditional	1 (0.3)	0 (0.0)	1 (0.3)	0 (0.0)		
Highest level of education	Masters	14 (3.8)	1 (0.3)	4 (1.0)	9 (2.4)	6	0.002
	Bachelor	126 (33.8)	28 (7.5)	23 (6.2)	75 (20.1)		
	Diploma	191 (51.2)	45 (12.1)	58 (15.5)	88 (23.6)		

Characteristics	Practice score						
	Certificate	42 (11.3)	18 (4.8)	13 (3.5)	11 (2.9)		
Source of Information	Social media	78 (20.9)	22 (5.9)	26 (7.0)	30 (8.0)	8	0.002
	News media	122 (32.7)	35 (9.4)	29 (7.8)	58 (15.5)		
	Website of hospital/GHS	81 (21.7)	10 (2.7)	20 (5.36)	51 (13.7)		
	Friends/relatives	14 (3.8)	8 (2.1)	4 (1.1)	2 (0.5)		
	International health organization	78 (20.9)	17 (4.6)	18 (4.8)	42 (11.3)		

According to the HBM, the modifying factors refer to factors influencing behaviour change. It includes the person's age, gender, ethnicity, personality, knowledge, and socioeconomic status (Tarkang & Zotor, 2015:4). There was a significant association between the healthcare worker participants' gender and their practices towards preventing the spread of COVID-19 infections (p=0.005). Most female participants (33%) had excellent practices. The finding is according to a study in Ethiopia (Fetansa et al., 2021:4). The age of the healthcare worker participants in their study was also associated with their practices towards preventing the spread of COVID-19 infections (p=0.037). Participants in the age group 20-39 years had excellent practices towards preventing the spread of infections (40.8%).

The study's findings revealed that no association existed between the participants' marital status, place of work, occupation/specialisation, religion, and their practices towards preventing the spread of COVID-19 infections; however, there was a significant association between their level of education and their COVID-19 preventive practices (p= 0.002). The healthcare worker participants with a higher level of education had excellent practices to prevent the spread of the infection.

The finding follows studies conducted in China and Ethiopia (Zhong et al., 2020:1749; Bitew et al., 2021:4). The variations may be related to higher education programmes preparing graduates to develop the habit of doing research, and this helped them to search for relevant information regarding COVID-19 and the prevention of the spread of the infection. Pertinent information acquisition leads to behaviour change and, therefore, good preventive practices. Another reason might be that those with a higher level of education may have a better understanding of the spread, effect, prevention, and control of infections.

The study findings confirm a positive association between the participants' source of information and their practices towards preventing the spread of COVID-19 infections (p=0.002). The participants who obtained information from their hospital /GHS website, news media, and international organisations, such as the WHO, had excellent practices for preventing the spread of COVID-19. This finding is according to three studies conducted in Ethiopia, Nepal, and India (Bitew et al., 2021:4; Nepal et al., 2020:12; Bhagavathula et al., 2020:2).

Table 3.11: Bivariate analysis of healthcare workers' knowledge, attitudes, and practices towards COVID-19 by using the Chi-Square

Variable	N	Df	P-value (2 sided)
Attitude vs. practice	373	1	0.022
Attitude vs. knowledge	373	1	0.048
Practice vs. knowledge	373	1	0.091

The results from the bivariate analysis revealed there was a significant positive association between the healthcare worker participants' attitudes and practices towards COVID-19 (p=0.022). The participants' attitude related positively to their knowledge of COVID-19 (p=0.048). The HBM and the KAP theory can explain this. "Knowledge is the foundation of behaviour (practice), and attitudes are the driving force of behaviour change" (Fan et al., 2018:2). "A person's intention of a specific behaviour is alienated from his/her attitude towards that particular behaviour" (Fan et al., 2018:3).

The study established a high knowledge level among the healthcare worker participants regarding COVID-19. An increase in knowledge level helps to reduce misinformation, eventually leading to a good attitude. Acquisition of knowledge by the participants enabled them to know their susceptibility to COVID-19 infection, the severity of the disease, the benefits of preventive actions, and their ability to initiate new preventive behaviours.

3.2.3 Testing the hypotheses

The Chi-square test (X^2) was conducted to test the hypotheses of Phase 1 of the study.

- H0: COVID-19 KAP has no relation to the biographic data of healthcare workers
- H1: COVID-19 KAP relates to the biographic data of healthcare workers

Regarding the Chi-square test, the null hypothesis (H0) was rejected since healthcare workers' biographic data (age, marital status, and gender) had a relation to their KAPs towards COVID-19. The alternative hypothesis (H1) was accepted.

- H0: COVID-19 KAP has no relation to healthcare workers' duration of experience
- H1: COVID-19 KAP has a relation to healthcare workers' duration of experience

The null hypothesis(H0) was also rejected since the duration of the experience related to healthcare worker participants' attitudes towards COVID-19. The alternative hypothesis was, therefore, accepted.

- H0: COVID-19 KAP has no relation to healthcare workers' specialisation.
- H1: COVID-19 KAP has a relation to healthcare workers' specialisation

The alternative hypothesis (H1) was rejected since there was no relation between the healthcare worker participants' specialisation/occupation and their KAPs towards COVID -19. The null hypothesis was accepted.

- H0: COVID-19 KAP has no relation to healthcare workers' place of work

- H1: COVID-19 KAP has a relation to healthcare workers' place of work

The null hypothesis (H0) was accepted, and the alternative was rejected since there was no relation between the healthcare worker participants' place of work and their KAPs towards COVID-19.

3.2.4 Conclusion

The researcher established that 85.8% of the healthcare worker participants had good knowledge of COVID-19. Age and religious affiliation were significantly associated with factors affecting the knowledge level about the novel coronavirus disease; 56.6% of the participants had a good attitude towards COVID-19. The duration of the experience and marital status of the participants were strongly associated with their attitudes. Less than 50% of the participants had good or excellent preventive practices towards COVID-19. Gender, level of education, and source of information were associated with the participants' practices towards COVID-19 prevention.

A divergence remains in their preventive practices towards COVID-19, suggesting that interventions should go far beyond just knowledge and attitude; however, strategies should be developed to prevent the healthcare-associated spread of COVID-19 and other respiratory infections in all health facilities across the globe.

3.3 Summary

Chapter Three describes the healthcare workers' KAPs towards COVID-19. Chapter Four comprises the literature review based on Phase 1 and strategy development.

CHAPTER FOUR
LITERATURE REVIEW AND STRATEGY DEVELOPMENT

4.1. Introduction

In the previous chapter, the findings of Phase 1 of the study specify a divergence in the knowledge base of healthcare workers' regarding respiratory infection and COVID-19. The researcher established that although a reasonable number (85.8%) of the HCWs had good knowledge of COVID-19, only 11% had excellent knowledge. Age and religious affiliation were significantly associated with factors affecting the knowledge level of the disease. According to the HBM, age and religion are among the modified factors influencing an individual's behavioural change.

Specific knowledge divergences identified among the healthcare workers refer to the transmission of the virus, diagnosis of the infection, and treatment of COVID-19: 92.5% agreed/strongly agreed that the novel coronavirus disease is transmitted mainly through the air; 59% of the HCWs agreed/strongly agreed that pets may be infected and transmission from pets is unknown; 52% of the HCWs agreed/strongly agreed that the primary method of diagnosis is identifying antibodies; 89.2% of the HCWs agreed/strongly agreed that antibiotics are the first line of treatment; and 80.6% of the HCWs agreed/strongly agreed that Chlorhexidine kills the SARS-CoV-2.

Some HCWs portrayed a good attitude towards COVID-19; 56.6% had a good attitude towards COVID-19. The duration of the experience and marital status of HCWs were strongly associated with their attitudes. According to the HBM, marital status and duration of the experience are among the modifying factors that can affect an individual's perception or belief towards initiating a new behaviour. Negative attitudes were also identified; 61.9% of the HCWs feared working in a hospital where COVID-19 patients were admitted; 58% of the HCWs also feared caring for COVID-19 patients; and 89.9% of the HCWs believed that they could become infected even with adequate protection, such as wearing PPE.

Less than 50% of the HCWs had good or excellent preventive practices towards COVID-19. Gender, level of education, and source of information were associated with the HCWs practices towards COVID-19 prevention. According to the HBM, gender is among the factors influencing a person’s behavioural modification towards a particular disease.

Specific preventive divergences identified: 41% of the HCWs had no access to appropriate PPE to prevent COVID-19 and other respiratory infections; 30% of the HCWs had received no training on donning PPE; 57% of the HCWs wore N95 face masks at the healthcare facility and only 42.9% tested the N95 mask before donning; 48.5% of the HCWs indicated a lack of N95 masks in their facility; 56% of the HCWs used their fluid-repellent surgical masks and eye protection for a session of work or other than a single patient; 76.9% of the HCWs wore gowns or coveralls for a session of work in high-risk areas only; and 90.3% of the HCWs disinfect linen/beddings used by patients infected with COVID-19 before sending them to the laundry.

A divergence in the HCWs’ preventive practices towards COVID-19 and other respiratory infections was identified, suggesting that interventions should go far beyond just knowledge and attitude; however, strategies should be developed to prevent the healthcare-associated spread of COVID-19 and other respiratory infections.

A thorough literature review based on the findings of Phase 1 provided sufficient evidence to draft strategies to prevent the healthcare-associated spread of COVID-19 and other respiratory infections. This chapter presents the outcome of the review of the literature and the drafting of strategies to avoid the healthcare-associated spread of respiratory infections. Chapter Two comprised the methodology of the evaluation.

4.2 Results of the literature review

The literature search conducted produced 16270 studies. Several 115 articles were manually reduced by screening the title and abstract using the inclusion criteria. The articles eligible for full–article screening was reduced to 66 papers. After the full-text article screening, 16 more studies did not include strategies. This resulted in 50 studies describing strategies to prevent the healthcare-associated spread of COVID-19 and other respiratory infections; 50 articles were used to discuss the themes and to draft a strategy to prevent healthcare-associated spread of respiratory infections. The (PRISMA) flow diagram for the screening and selecting the studies in the review is outlined in Figure 4.1.

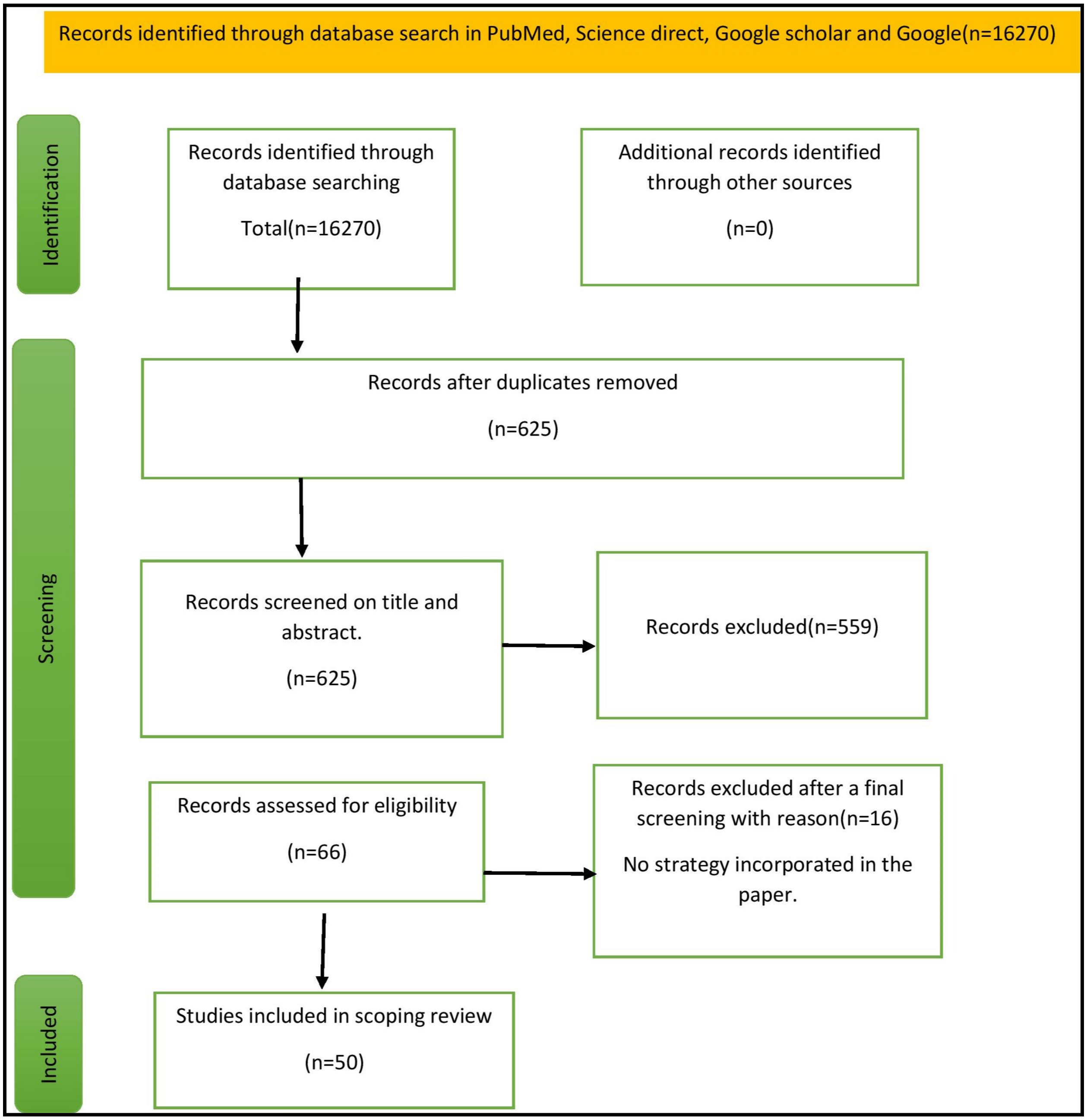


Figure 4.1: PRISMA flow diagram

The extracted data were entered into a self-developed template with these headings:

- Author and year of publication
- Title of the study
- Country
- Study aim
- Design
- Methods
- Setting
- Participants
- Key study findings
- Strategies drafted from the publication

4.3 Characteristics of the included studies

Table 4.1 presents a summary of characteristics of the included studies.

Table 4.1: Summary of characteristics of included studies

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Ahmad J, Anwar S, Latif A, Haq N.U, Sharif M., Nauman A.A. Association of PPE Availability, Training, and Practices with COVID-19 Sero-Prevalence in Nurses and Paramedics in Tertiary Care Hospitals of Peshawar, Pakistan. 2020 Disaster Med Public Health Prep. 16 (3):975-979. Pakistan	The study aimed to assess the impact of PPE availability, training, and practices on COVID-19 seroprevalence among nurses and paramedics in Peshawar, Pakistan, teaching hospitals.	Descriptive/analytic quantitative cross-sectional survey; Telephone interviews using a structured questionnaire; 133 nurses and paramedics in teaching hospitals of Peshawar.	The findings indicate that the healthcare professionals who received PPE on time at the start of COVID-19 had fewer chances of contracting the infection; availability of PPE, COVID-19-related training, and compliance with the WHO recommended practices were instrumental in	There should be an adequate supply of PPE to all HWCs; they should have access to the updated PPE protocol recommended by the WHO; training of all HWCs on preventing respiratory infections is advised.

			protection against infection.	
Alqahtani, J.S., Aldhahir, A.M., Al, Rabeeah, S.M., Alsenani, L.B., Alsharif, H.M., Alshehri, A.Y., Alenazi, M. M., Alnasser, M., Alqahtani, A.S., AlDraiwiesh, I.A., Alghamdi, S.M., Siraj, R.A., Alqahtani, H.S., Sreedharan, J.K., Alqahtani, A.S., & Alzahrani, E.M. Future Acceptability of Respiratory Virus Infection Control Interventions in General	The study aimed to evaluate the level of public acceptance towards maintaining the same infection control practices used during the SARS-CoV -2 pandemic and whether the public feel the need for formal health policies and legislation mandating non-pharmaceutical interventions (NPIs) to prevent future respiratory infections.	Quantitative Cross-sectional survey: a validated survey conducted to determine community acceptance of the measures; 2057 residents of Saudi Arabia older than 18 years old.	93% indicated that they would continue washing their hands more often; 92% wanted clinicians and patients to wear masks in hospitals; 86% would continue avoiding smoking in indoor and outdoor areas; 73% would continue wearing a face covering on public transportation; 70% indicated that they would continue wearing a face covering in indoor	Regular washing of hands by staff and patients; wearing masks in hospitals by patients and staff; taking vaccination as recommended by the Ministry of Health; hand sanitiser should be widely available to clean hands; avoiding smoking in indoor and outdoor areas; keeping more distance from others when in an indoor public space.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Population to Prevent Respiratory Infections. 2022 Medicina (Kaunas, Lithuania), 58 (7), 838. Saudi Arabia			public places. Regarding the respiratory virus infection control measures, 85% supported continuation as policies.	
Alsaedi, A., Alharbi, M., Ossenkopp, J., Farahat, F., Taguas, R., Algarni, M., Alghamdi, A., Okdah, L., Alhayli, S., Alswaji, A., Doumith, M., El-Saed, A., Alzahrani, M., Alshamrani, M., Alghoribi, M.F.	The study aimed to share a practical experience on COVID-19 outbreak containment, including contact tracing, screening of the target population, testing including molecular	Descriptive retrospective medical chart review study of SARS-CoV-2 infection outbreak among healthcare providers and patients; 40 nurses and 37 admitted	Eight nurses (20 % of the assigned ward nurses) and six patients (16.2 % of the ward admitted patients during the outbreak) tested positive for the SARS -CoV-2 virus based on PCR testing. The	Maintain screening checkpoints for respiratory symptoms among healthcare workers; they need to be aware to immediately report if they suffer any COVID-19-related symptoms and to be assessed for further work

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Epidemiological and molecular description of nosocomial outbreak of COVID-19 Alpha (B.1.1.7) variant in Saudi Arabia. 2022 J Infect Public Health. 15 (11):1279-1286. Saudi Arabia	analysis, and preventive modalities.	patients in a referral tertiary care hospital in Jeddah.	outbreak investigation identified strong evidence of an epidemiologic link between the affected cases.	restrictions; universal masking, social distancing, and hand hygiene are basic protective measures that need to be reinforced and emphasised not only during patient care but also during gatherings and meetings in all facilities.
Anguraj, S., Ketan, P., Sivaradjy, M., Shanmugam, L., Jamir, I., Cherian, A., Sankar, Sastry, A. The effect of hand hygiene audit in COVID	The study aims to determine the Hand Hygiene compliance rate among HCWs in COVID-19 care settings and evaluate the impact of Hand	This prospective study was conducted for six months in the COVID-19 ICU at Jawaharlal Institute of Postgraduate	Hand hygiene complete adherence rate (HHCAR), hand hygiene partial adherence rate (HHP AR), and Hand hygiene total	The infection control department of the facilities should regularly conduct hand hygiene audits in COVID-19/respiratory infection locations; and improve

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
intensive care units in a tertiary care hospital in South India. Am J Infect Control. 49 (10):1247-1251. 2021 India	Hygiene compliance in reducing Healthcare -associated infections in COVID-19 Intensive care units (ICU) settings by auditing Hand Hygiene practices.	Medical Education and Research(JIPMER) , a tertiary care hospital in Pondicherry, South India; 2, 232 hand hygiene opportunities were observed among healthcare professionals.	adherence rate (HHTAR) were established as 30.8%, 34.5%, and 65.3% respectively. There was a significant increase in the monthly HHTAR from 26.7% to 68.4%The profession -specific HHTAR was highest among doctors (67.5%) and nurses (66.4%).	the HHCAR by following the WHO steps for the recommended duration.
Badr, H., Oluyomi, A., Woodard, L., Zhang, X. Raza strongly agree (SA), Adel Fahmideh,	The study aimed to identify sociodemographic characteristics and	Quantitative online Population-based survey, conducted among 2, 222	The male gender was significantly associated with reporting lower levels	Public health campaigns that emphasise individual risk, and provide clear, consistent guidance on

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
M., El-Mubasher, O., Amos, C.A. Sociodemographic and HBM Factors Associated with Non-adherence to COVID-19 Mitigation Strategies in the United States. 2021 Ann Behav Med. 55 (7):677-685. United States of America	HBM factors associated with non-adherence to COVID-19 mitigation strategies with the goal of informing public health messaging campaigns.	Residents in the United States.	of adherence to COVID-19 mitigation strategies and higher levels of perceived threat, perceived control, and knowledge about how to keep oneself and others safe from COVID-19 were significantly associated with reporting higher levels of adherence to COVID-19 mitigation strategies.	what individuals can do to decrease their risk for COVID-19, may be effective in motivating increased mitigation adherence; and adhere to social distancing recommendations.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Bludau, A., Heinemann, S., Mardiko, A.A., Kaba, H.E.J., Leha, A., von Maltzahn, N., Mutters, N.T., Leistner, R., Mattner F., Scheithauer S. Infection control strategies for patients and persons during the COVID-19 pandemic in German hospitals: a cross-sectional study in March-April 2021. 2022 J Hosp Infect.125:28-36. Germany	To collect information about COVID-19 infection control strategies for patients and persons from infection control practitioners in German hospitals.	Quantitative cross-sectional design; 100 Infection control practitioners in selected German hospitals participated in the study.	A higher proportion of large (71%) than small (49%) hospitals let patients decide freely whether to wear medical or FFP2 masks. Most hospitals reported spatial separation for COVID-19 patients and non-COVID-19 cases or, additionally, for suspected COVID -19 cases. Accompaniment bans were more prevalent in large hospitals than in small	Wearing masks should be recommended for patients and persons; allow one guardian visitor for underage patients; informing patients about desired hygiene behaviour by oral distribution before admission, written information, and distribution of brochures and posters in patient rooms; social distance of about 1.5m between COVID-19 and non-COVID-19 patients enforced.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			hospitals, but large hospitals granted more exemptions.	
Burdsall. D. Non-ventilator healthcare-associated pneumonia (NV-HAP): Long-term care. 2020 Am J Infect Control. 48 (5S): A14-A16. Palatine	The study outlines strategies to prevent the increased risk of NV-HAP among individuals residing in long-term care facilities.	Descriptive Implementation guidelines for long-term care with detail on modifiable and non-modifiable risk factors for acquiring pneumonia.	The guideline remarked that potentially modifiable factors for pneumonia (such as vaccine refusal, immobility and poor staff and residents' hand hygiene) and non-modifiable factors (such as immune-suppression/blunted	Identification of patient-specific risks for developing respiratory infections; an active surveillance programme within an established infection prevention programme; promote prevention strategies, such as hand hygiene, respiratory etiquette, vaccination programme for staff and residents

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			immune response and cancer) contribute to non-ventilator healthcare-associated infections. Strategies to prevent infections refer to identifying patient-specific risks and the consideration of the risks in care planning. A surveillance programme within an established infection prevention programme, including identification of	and patients; ensure adequate environmental cleaning and disinfection, and transmission-based precaution; ensure environmental controls, including comprehensive water management plans and programmes, to reduce the risk of exposure to respiratory infections for patients, healthcare workers, and family members.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			symptomatic individuals, notification and collaboration with public health, and segregation of symptomatic or colonised individuals, is an evidence-based approach to reduce the risk of respiratory infections and pneumonia.	
Calcagni, N., Venier, A.G., Nasso, R., Boudin, G., Jarrige, B., Parneix, P., Quintard, B.	The study aimed to identify the perception of Healthcare professionals(HCPs) about Respiratory	Qualitative study; an interview grid, including open-ended and non-inductive questions,	HCPs considered respiratory infections as benign. They associated respiratory hygiene	Respiratory hygiene, protective behavioural measures, such as smoking cessation, frequent aerating the

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Respiratory infection prevention: perceptions, barriers, and facilitators after SARS-CoV-2. 2022 Infect Dis Health (1):54-63. France	infections and the ways to prevent them, but also to identify the barriers they encountered and the factors that could facilitate good practices.	was developed for the individual and focus-grouped interviews; 13 healthcare professionals for individual interviews and seven participants for the focus group practising in Nouvelle-Aquitaine and Iles de Guadeloupe in France. They were sampled through purposive sampling.	with observing cough etiquette, the preservation of lung health, the act of protecting oneself and others, and the adherence to safety protocols. The main barriers to good practices were organisational ones, such as the lack of consultation and mobilisation of Healthcare professionals in developing preventive measures,	rooms, and healthy habits, such as exercise, cough etiquette, hand washing, face masking, social distancing, and the responsible use of tissues advised.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			suboptimal information sharing and the physical and relational constraints of face masks.	
Candevir, A., Üngör, C., Çizmeci Şenel, F., Taşova, Y. How efficient are facial masks against COVID-19? Evaluating the mask use of various communities one year into the pandemic. Turk J Med Sci. 51 (SI-1):3238-3245. 2021	The study aimed to review articles studying the protective effect of masks on COVID-19 with laboratory evidence.	Twelve studies, including meta-analysis, case-control, cross -sectional, cohort, retrospective, retrospective cross-sectional, research, randomised controlled, and controlled comparison studies, conducted	Continuous wearing of N95 respirators may have the best protection against viral respiratory diseases.	Medical face mask use should be encouraged in healthcare facilities (N95 mask use among HCWs has the best protection against viral respiratory infections). Hand hygiene practices.

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
Turkey		in China, United Kingdom, United State of America, Thailand, Uganda, Ethiopia, South Korea, Canada, and Iran were reviewed on the protective effect of masks on COVID-19.		
Chadsuthi, S & Modchang, C Modelling the effectiveness of intervention strategies to control COVID-19 outbreaks and	The aim of the study is to discover the best strategy to reduce the spread of COVID-19 through non-pharmacological interventions.	The susceptible exposed infectious recovery (SEIR) model was modified to study the dynamics of COVID-19	Contact tracing could reduce the peak of ICU beds and mass testing. The time delay between diagnosis and self-isolation influences	Individuals who have had contact with infectious cases of COVID-19 must be quarantined as soon as possible; keep physical distance with fewer contacts;

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
estimating healthcare demand in Germany 2021 Public Health in Practice 2 (2021) 100121 Thailand		transmission in Germany.	the control measures. Physical distancing to limit the contact rate would delay the outbreak's peak.	vaccination programmes instituted; healthcare facilities must be prepared with sufficient non-ICU and ICU beds to meet the demands during an outbreak.
Cheng, C.W., Huang, PY, Wu, T.S., Huang, C.G., Tsao, K.C., Lin, C.S., Chung, T.Y., Lai, C.C., Yang, C.T., Chiu, C.H. Infection Control Working Group. Infection control operations of a large	The study demonstrated integrated teamwork, and executing comprehensive, dynamic infection control measures within a large hospital could efficiently mitigate COVID-19	Case-control study; implementation of dynamic infection control policies during the pandemic was initiated. All HCWs in Chang Gung Memorial Hospital at Linkou having	A total of 5, 722 patients were tested in the hospital from January to May 2020; twenty-five (25) patients were confirmed COVID-19, including two inpatients. A cluster of four HCWs with	Infection control measures, and strict adherence to PPE protocol for all hospital staff; wearing surgical masks, hand hygiene, Early detection for symptomatic staff and patients during hospitalisation, and

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
hospital in Taiwan to prevent nosocomial outbreaks during COVID-19 pandemic. Biomed J. 244 (6 Suppl 1): S8-S14. 2021 Taiwan	nosocomial outbreaks and maintain the core function of the hospital.	symptoms or close contact with the confirmed case received the RT-PCR test.	COVID-19 associated with the second inpatient was identified in the early stage of the pandemic.	universal testing of patients upon admission should be implemented in a high COVID-19 prevalence area; screening asymptomatic patients should be evaluated according to the community prevalence, testing resources and the vulnerability of the patients; complete vaccination for staff.
Lim, R.H.F., Htun, H.L., Li A.L., Guo, H., Kyaw, W.M., Hein, A.A., Ang, B., Chow,	The study aimed to review the enhanced strategies in preventing nosocomial	A Cohort study was conducted among staff, patients, and	From 193 unexpected COVID-19 exposures, 2, 573 staff, 542 patients,	Upgraded PPE for staff, patients, and visitors (HCWs managing suspected/confirmed

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
A. Fending off Delta - Hospital measures to reduce nosocomial transmission of COVID-19. Int J Infect Dis. 117:139-145. 2022 Singapore	transmission of COVID-19 following widespread community transmission of the Delta variant.	visitors at Tan Tock Seng Hospital.	and 128 visitor contacts were traced. Four staff contacts subsequently had SARS-CoV-2 infection. Two were likely from exposure to community settings, whereas two had exposure to the same COVID-19-positive staff in the hospital, forming the only hospital cluster. One inpatient had a nosocomial infection, possibly from visitors. The SARS-CoV-2	COVID-19 cases working in high-risk areas or performing aerosol-generating procedures had to put on a full set of PPE; N95 mask or equivalent, gown, gloves, and eye protection); rostered routine testing (RRT) for staff and patients; surveillance of staff with Acute respiratory illness; quarantine measures for contact with potential COVID-19 exposure.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			detection rate among staff was 0.3% from Rostered Routine Testing every other week and 2.5% from Acute Respiratory Infection surveillance.	
Crnich, C.J. Reimagining Infection Control in U.S. Nursing Homes in the Era of COVID-19. J Am Med Dir Assoc.23 (12):1909-1915. 2022 United States of America	The aim of writing this article is to call for reimagining the Nursing Home infection control programme using the systems engineering initiative for patient safety framework.	Guideline/Recommendations.	The existing structure of the infection control programme in most NHs is inadequate and requires a major change in these settings to become safer and more resilient in healthcare environments.	Infection prevention control implemented; a training programme for staff initiated; Government and professional organisations should invest in research to develop more effective vaccines and respiratory tract infection

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
				chemoprophylaxis treatments; appoint infection prevention staff to control all facilities.
European Centre for Disease Prevention and Control. (ECDC) Considerations for infection prevention and control regarding respiratory viral infections in healthcare settings. 6 February 2023. ECDC: Stockholm; 2023 European Union	The document aims to support developing guidance for healthcare facilities and healthcare providers in the EU/EEA on infection prevention and control (IPC) measures for the management of patients with respiratory tract viral infection in healthcare settings.	Technical report on infection prevention and control practices regarding respiratory viral infections in healthcare settings in the European Union.	The report recommended the protection of staff (using masks, receiving training, and being vaccinated) and reducing workplace risks (regular cleaning and disinfection).	Wearing PPE; implementing hand hygiene practices; appropriate training on recommended IPC measures for healthcare workers and other staff; vaccination of all staff; workplace risk assessment should be revised; strategy should be defined for testing management and follow-up of HCWs with

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
				respiratory symptoms under national authorities; regular cleaning and disinfection of the workplace and electronic equipment; ensure adequate ventilation.
Glowicz, J.B., Landon, E., Sickbert-Bennett, E.E., Aiello, A.E., deKay, K., Hoffmann, K.K., Maragakis, L., Olmsted, R.N., Polgreen, P.M., Trexler, P.A., VanAmringe, M.A., Wood, A.R., Yokoe, D., Ellingson, K.D.	This document emphasises practical recommendations to assist acute-care hospitals in the prioritisation and implementation of strategies to prevent healthcare-associated	Guideline on strategies to prevent healthcare-associated infections through hand hygiene.	Promote the maintenance of healthy hand skin and fingernails; perform hand hygiene as indicated by the Centers for Disease Control and Prevention (CDC) or the WHO; educate	Promote hand hygiene practices among healthcare workers and monitor hand hygiene adherence.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. Infect Control Hosp Epidemiol. 44 (3):355-376. 2023 United States of America	infections through hand hygiene.		HCWs about the appropriate volume of alcohol-based hand sanitisers and the time required to achieve effectiveness; ensure accessibility of hand hygiene supplies; monitor adherence to hand hygiene.	
Hutchinson, N.T., Steelman, A, Woods, J.A.	This review article outlines the immune response to viral pathogens owing to COVID-19 and the	Review article	The combination of the outlined strategies has proved to be the most effective concerning	Encourage regular moderate exercise, face covering, personal and workplace hygiene, and social distancing.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Behavioural strategies to prevent and mitigate COVID-19 infection. Sports Med Health Sci. 2 (3):115-125. 2020 United States of America	large body of evidence suggesting the respiratory and immune benefits of regular moderate-intensity exercise.		behavioural prophylaxis to delay spread, reduce the number of cases, and delay and reduce the peak attack rate of COVID-19 infection.	
Jang, W., Kim, B., Kim, E.S., Song, K.H., Moon, S.M., Lee, M.J., Park, J.Y., Kim, J.Y., Shin, M.J., Lee, H., Kim, H.B. Differences in strategies to prevent COVID-19 transmission in hospitals: nationwide	To survey the current strategies for preventing the transmission of COVID-19 in medical institutions.	Quantitative Cross-sectional survey; 46 hospitals in Korea participated in the survey.	89.1% allowed symptomatic patients without COVID-19-associated symptoms to visit general outpatient clinics. Most hospitals conducted polymerase chain reaction (PCR) tests	PPE for HCWs; hospital work restriction policy for HCWs; existence of screening clinics for COVID-19; restrictions for caregivers and visitors; education on mask-wearing for patients and caregivers during hospitalisation;

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
survey results from the Republic of Korea. J Hosp Infect.129:22-30. 2022 Korea			for all hospitalised patients. Thirty-five of the 46 hospitals had pre-emptive isolation policies for hospitalised patients.	banners and postings on thoroughly and properly wearing masks are positioned throughout the institution; PCR test for non- suspected cases of covid-19; isolation practices for patients with symptoms suggesting of COVID-19 and with a confirmed diagnosis.
Karam, K.A., Hota, P., Mora, S.J., Lowell, A., McKay, K., Xian, X., Patel, B., & Forzani, E. Development of a new Aerosol Barrier Mask for mitigation of spread of	The study aimed to develop a new aerosol barrier mask to reduce the spread of COVID-19 and other respiratory infections.	The tests were conducted by Arizona State University (ASU) researchers at Mayo Simulation	The development of a novel aerosol barrier mask (ABM) to mitigate the spread of SARS-CoV-2 and other infectious pathogens. This	Provision of new ABMs for preventing COVID-19 and other infections while transporting patients within the healthcare facility.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
SARS-CoV-2 and other infectious pathogens. Journal of Respiratory Medicine 181 (2021) 106381 2021 United States of America		Centres in Phoenix, Arizona.	Aerosol Barrier Mask has been designed to prevent SARS-CoV-2 transmission while transporting patients within hospital facilities. This mask can constrain aerosol and droplet particles and trap them in a biofilter while the patient usually is breathing and administered with medical oxygen.	
Kitt, E., Handy, L.K., Coffin, S.E.; Healthcare-Associated Viral		Letter to the editor.	Key findings from the article are that the COVID-19 pandemic	Hand hygiene, consistent environmental cleaning, adequate supply of

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Infection Harm Prevention Team. Response to: What will be the precaution for healthcare-associated rhinovirus infection outbreaks? 2023 American Journal of Infection Control 51 (2023) 358−359 United States of America			has emphasised several respiratory viral transmission dynamics that can be prevented successfully through ongoing education of healthcare professionals about good hand hygiene, consistent environment cleaning, and visitor restriction.	Alcohol-based hand rub, visitors screening, and engaging caregivers in preventive practices. Education of staff on IPC measures.
Li K.K.F., Jarvis strongly agree (SA), Minhas F. Elementary effects analysis of factors	This study aimed to investigate the effectiveness of masks, social	Quantitative study: an agent-based stimulation was developed based	Findings from an agent-based simulation modelling indicated that while	Social distancing and mask-wearing.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
controlling COVID-19 infections in computational simulation reveals the importance of social distancing and mask usage. 2021 Computers in Biology and Medicine 134:104369. United Kingdom	distancing, lockdown, and self-isolation in reducing the spread of SARS-CoV-2 infections.	on the susceptible-infected-recovered-dead (SIRD) model to investigate the effectiveness of various NPIs, such as masks, social distancing, lockdown, and self-isolation for reducing the spread of COVID-19.	requiring a lockdown is widely believed to be the most efficient method to reduce infection numbers quickly, the practice of social distancing and the usage of surgical masks can be more effective than requiring a lockdown.	
Di Cola, S., Gazda, J., Lapenna, L., Ceccarelli, G., Merli, M. IPC programme and COVID-19 measures:	This study aimed to investigate the impact of an IPC program and coronavirus disease 2019 (COVID-	A combination of retrospective and prospective interventional cohort study in a	The IPC programme is associated with a reduction in the incidence of hospital-acquired infections.	PPE for staff and patients; restriction of patient's movements on the ward; restriction of relative's access to visit

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Effects on hospital-acquired infections in patients with cirrhosis. 2023 JHEP Rep. 5 (5):100703. Italy	19) measures on the incidence of hospital-acquired infections and a set of secondary outcomes, including the prevalence of multidrug-resistant organisms, empiric antibiotic treatment failure, and development of septic states in patients with cirrhosis.	tertiary liver care centre, University Hospital -Policlinico Umberto 1, Rome; 941 patients participated in the study.	No further reduction was present after the COVID-19 measures had been imposed. The impact of the IPC programme remained significant even after controlling for the effects of confounding variables.	hospitalised patients; postponing all immediate unnecessary examinations during an outbreak of respiratory pandemics.
de Miranda Costa, M.M., Santana H.T, Saturno Hernandez,	The aim of the study is to analyse the effect of a national system-wide quality	A QI cycle approach was designed and assessed with a	The Healthcare-associated Infection rates of the participating hospitals	Healthcare-associated respiratory infections surveillance; a protocol implemented to prevent

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
P.J., Carvalho, A.A., da Silva Gama, Z.A. Results of a national system-wide quality improvement initiative for implementing evidence-based infection prevention practices in Brazilian hospitals. 2020 J Hosp Infect May;105 (1):24-34. Brazil	improvement (QI) initiative aimed at promoting HCAI prevention through regulatory interventions in Brazil.	before and after quasi-experimental design; 563 hospitals in the baseline and 681 hospitals in the second phase across all regions in Brazil were included.	decreased after the intervention.	ventilation-associated respiratory tract infections; advocate hand hygiene, regular monitoring of hand hygiene adherence by staff; training of staff to prevent infection spread.
Mouallem, R.E., Moussally, K., Williams, A., Repetto, E.,	This study outlines and provides examples of the challenges	Perspective	Implementing high-quality IPC measures in conflict-affected settings in the Middle	Training of HCWs on IPC; Government and professional bodies should make IPC a

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Menassa, M., Martino, C., Sittah, G.A. How COVID-19 emphasised the need for IPC measures to become central to the global conversation: experience from the conflict settings of the Middle East. 2021 International Journal of Infectious Diseases 111: 55–57 Lebanon	encountered across the Middle East conflict setting and serves as a call for action for IPC to be prioritised, provided the resources needed, and fed with contextualised evidence.		East has been a neglected priority for several years. It calls for action for health and non-health experts to join efforts to combat healthcare -associated infections through quality IPC, specifically tailored for conflict and highly insecure settings.	component of the medical curriculum; allocate necessary resources for IPC to facilities; and regular monitoring of IPC activities.

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
Negera et al. Negera, A., Hailu, C., Birhanu, A. Practice towards Prevention and Control Measures of Coronavirus Disease and Associated Factors among Healthcare Workers in the Health Facilities of the Horo Guduru Wollega Zone, West Ethiopia. 2022 Glob Health Epidemiol Genom. Ethiopia	This study assessed the level of practice, prevention, and control measures of the COVID-19 pandemic and the associated factors among healthcare workers in health facilities.	A quantitative cross -sectional study design was used among 334 samples of health workers who were selected using a stratified two-stage sampling technique, from health facilities of the Horo Guduru Wollega Zone from May to June 2021	Among the participating HCWs, 64% had good practices of prevention and control measures for COVID-19 Multivariable binary logistic regression revealed that being a healthcare worker, being trained, and having sufficient knowledge was significantly associated with good preventive practice.	Expansion of sustainable infection control and prevention strategies for staff; training of staff refresher courses on standard precautions; provision of PPE for all staff; increase vaccination coverage for staff.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Ochie, C.N., Aniwada, E.C., Uchegbu, E.K., Asogwa, T.C., Onwasoigwe, C.N. IPC: knowledge, determinants, and compliance among primary healthcare workers in Enugu metropolis, south-east Nigeria. 2022 Infection Prevention in Practice 4 (2) Nigeria	This study aimed to assess the knowledge, determinants, and compliance of IPC among primary healthcare workers in Enugu Metropolis.	A Quantitative Cross-sectional study was conducted using a semi-structured interview administered questionnaire. A multistage sampling technique was used to select 300 Health Care Workers in Primary Health Care facilities in the Enugu metropolis.	Only 254 (84.7%) of the respondents had previous IPC training, and 82 (27.3%) had good knowledge of IPC. A majority, 244 (81.3%), could not correctly identify all the moments of hand washing.	There should be continuous training of HCWs on IPC to reduce the spread of respiratory infections.

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
Osula, V.O., Sanders, J.E., Chakare, T., Mapota-Masoabi, L., Ranyali-Otubanjo, M., Hansoti, B., McCollum E.D. COVID-19 advanced respiratory care educational training programme for healthcare workers in Lesotho: an observational study. 2022 BMJ Open.12 (4) Lesotho	To develop and implement a 'low-dose, high-frequency' (LDHF) advanced respiratory care training program for COVID-19 care in Lesotho.	Prospective pre-training–post-training evaluation; 70 Nurses and Physicians of Bere and Mafeteng Hospitals were invited for a day training.	There was significant improvement in the post-training examination scores as compared to the pre-test examination scores, especially with questions related to respiratory management and physiology.	Respiratory care education training for HCWs.

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
Sandaradura, I., Goeman, E., Pontivivo, G., Fine, E., Gray, H., Kerr, S., Marriott, D., Harkness, J., Andresen, D. A close shave? Performance of P2/N95 respirators in healthcare workers with facial hair: results of the BEARDS (BEnchmarking Adequate Respiratory Defences) study. 2020 J Hosp Infect (4):529-533 Australia	The study aimed to examine the fit of standard filtering face piece respirators (FFRs) among a cohort of hospital-based male Healthcare workers.	Quantitative respirator fit a survey among 105 male healthcare workers in St Vincent's Hospital Darlinghurst.	No full-bearded HCWs achieved a fit. Adequate respirator fit decreased significantly with increasing facial hair.	HCWs with a full beard should be discouraged as N95 respirator fit rates are low in these people.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Tashkandi, N., Aljuaid, M., McKerry, T., Alchin, J., Taylor, L., Catangui, E.J., Mulla, R., Sinnappan, S., Nammour, G., El-Saed, A., Alshamrani, M.M. Nursing strategic pillars to enhance nursing preparedness and response to COVID-19 pandemic at a tertiary care hospital in Saudi Arabia. J Infect Public Health. 2021 Sep;14 (9):1155-11602021 Saudi Arabia	The study objective was to share their nursing experience in responding to the COVID-19 pandemic at a large hospital and its impact on nursing. safety and healthcare services.	Six nursing strategic pillars were implemented.	Out of 5483 nurses, 543 (10%) were trained for redeployment, mainly at acute and ICU. After serving 11, 623 infected patients including 1646 hospitalisations during the first nine months of the pandemic, only 385 (7.0%) nurses were infected with COVID-19. Out of them, only 10 (2.6%) required hospitalisation, one (0.3%) required ICU	Comprehensive surveillance of all patients; isolation of suspected and confirmed cases; triaging, physical distancing. infection control measures; maintaining an adequate supply of PPE; training and redeployment of nurses and implementing alternate staffing models; monitoring staff well-being, establishing mental health support, and giving financial incentives.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			admission, and none died.	
Thibon, P., Breton, P., Mouet, A., Bidon, A., Haupais, F., Darrigan, C., Gautier, P., Letourneur, T., Perillieux, E., Seguineau, C., Thibon, P., Henry, L., Ar Gouilh, M., Borgey, F., Le Hello, S., & ECRAN Investigation group Healthcare-associated coronavirus disease 2019 among healthcare workers in Normandy,	The study aimed to report the results of a multicenter regional survey, where nosocomial transmissions of COVID-19 involving HCWs at an early stage of the pandemic were identified and described.	A multicenter descriptive study of fifty-two (52) heath care facilities covering 30, 533 Healthcare workers in western Normandy from 3 March to 27 March 2020	The incidence rate of COVID-19 in HCWs was 2.7%. Among 19 situations, 10 were HCW-to-HCW, and nine were patient-to-HCW transmission.	Encourage hand hygiene, wearing PPE; adequate triaging and bed allocation; mandatory vaccination for staff.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
France: a multicentre study 2021 Infection prevention 3 (1), 100109. France				
Vicentini, C., Garzaro, G., Cornio, A.R., Bosio, D., Bergamaschi, E., Parravicini, G.P., Zotti, C.M. The Italian policy of mandating SARS-CoV-2 vaccination for healthcare workers: Analysis of the policy processes and preliminary outcomes	To describe the policy processes and preliminary results of introducing compulsory vaccination against SARS-CoV-2 for HCWs in Italy.	Health policy	The policy has so far had a positive impact on increasing vaccine uptake and lowering infection rates among healthcare workers.	Mandatory vaccination for all healthcare workers against respiratory infections

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
2023 Health Policy: 128:49-54. Italy				
Vimercati, L., Dell'Erba, A., Migliore, G., De Maria, L., Caputi, A., Quarato, M., Stefanizzi, P., Cavone, D., Ferorelli, D., Sponselli, S., Mansi, F, Tafuri, S. Prevention and protection measures of healthcare workers exposed to SARS-CoV-2 in a university hospital	This study describes the prevention procedures introduced at the University Hospital of Bari, Italy, to reduce the risk to HCWs, consisting of enhanced preventive measures and activation of a report system to collect HCWs contacts.	The protocol was applied for all 5750 HCWs working at the University Hospital of Bari for a 30-day observation period after implementation of the protocol.	Twenty-three (23) confirmed cases of infection (0.4% of all HCWs) were reported in the 30-day observation period following protocol implementation.	Implement general hygiene practices; avoidance of handshake; frequent air changes in rooms; physical isolation of suspected infected patients; disinfection of rooms; avoidance of overcrowding; appropriate utilisation of PPE; education on correct donning of PPE.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
in Bari, Apulia, Southern Italy 2020 J Hosp Infect.105 (3):454-458. Italy				
Lee, I.K., Wang, C.C., Lin, M.C., Kung, C.T., Lan, K.C., Lee, C.T. Effective strategies to prevent coronavirus disease-2019 (COVID-19) outbreak in hospitals. 2020 J Hosp Infect.105 (1):102-103 Taiwan	The study aimed to provide valuable strategies which can be effectively implemented to prevent the transmission of COVID-19 in healthcare settings and measures to contain future hospital outbreaks.	Letter to the editor.	147 suspected cases owing to COVID-19 were isolated at Kaohsiung Chang Gung Memorial Hospital (KGCMH), and no nosocomial cases were recorded	Screening and isolation of suspected/confirmed cases; education/training of hospital staff; limiting visitors' numbers in healthcare facilities; avoiding overcrowding in hospitals; initiation of the emergency response team to organise human resources and financial

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
				and physical resources during an outbreak.
Wee, LE, Venkatachalam, I., Sim, X.Y.J., Tan, K.B., Wen, R., Tham, C.K., Gan, W.H., Ko, K.K.K., Ho, W.Q., Kwek, G.T.C., Conceicao, E.P., Sng, C.Y.E., Ng, X.H.J., Ong, J.Y., Chiang, J.L., Chua, Y.Y., Ling, M.L., Tan, T.T., Wijaya, L. Containment of COVID-19 and reduction in healthcare-associated respiratory viral	The aim of the study is to devise and evaluate a multi-tiered infection control strategy to prevent nosocomial transmission of SARS-CoV2 and other Respiratory viral infections across a large healthcare setting.	From January to June 2020, a multi-tiered infection control strategy was implemented in the Singapore General Hospital and four other subspecialty centres with over 10,000 HCWs.	COVID-19 rates among HCWs were kept low (0.13%) and reflected community acquisition rather than nosocomial spread. Rates of healthcare-associated Respiratory viral infections among inpatients fell to zero (0), and this decrease was sustained even after	Screening of HCWs and patients with respiratory symptoms for covid-19 and other 16 common respiratory viral infections; improving segregation, and IPC measures; environmental cleaning; hand hygiene audit; wearing of surgical masks.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
infections through a multi-tiered infection control strategy 2021 Infect Dis Health. 26 (2):123-131. Singapore			visitor restrictions were lifted.	
Wilson, A.M., Sleeth, D.K., Schaefer, C., Jones, R.M. Transmission of Respiratory Viral Diseases to Health Care Workers: COVID-19 as an Example. 2022 Annu Rev Public Health. 43:311-330.	The objective of this article is to review evidence regarding the transmission of viral respiratory infections to HCWs from patients, using COVID-19 as the primary example.	Annual review	Strong evidence indicates that COVID -19, such as other viral respiratory infectious diseases, is an aerosol-transmissible disease. Key knowledge divergences about transmission	Face covering, adequate ventilation, physical distancing, cleaning of fomites, vaccination.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
United States of America			processes and control strategies were identified.	
Winkler, M.L., Hooper, D.C., & Shenoy, E.S. IPC of Severe Acute Respiratory Syndrome Coronavirus two in Health Care Settings. 2022 Infectious disease clinics of North America, 36 (2), 309–326. United States of America	This article reviews the chain of transmission of infectious agents, including SARS-CoV2, and recommends IPC practices to mitigate the risk of transmission of SARS-CoV-2 in healthcare settings, including implementation of the Hierarchy of controls and evaluation and	Integrated Review Nine articles	Transmission of infectious agents in healthcare settings can be interrupted by applying the Hierarchy of Controls. Observed transmission events in healthcare settings often involve multiple lapses in control measures, including healthcare personnel presenteeism, lack of	Elimination: visitor restriction, use of telemedicine, vaccination of staff; substitution: nebuliser treatments with metered dose inhalers, cleaning surfaces; engineering control: isolation practices; administrative controls: changing of workflow, screening of HCWs, visitors, and patients with respiratory symptoms: use of PPE: an adequate

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
	management of potential nosocomial transmission.		compliance with IPC measures, and unrecognised patient infections.	supply of PPE per standard and transmission-based precautions.
Lu, D., Wang, H., Yu, R., Yang, H., & Zhao, Y. Integrated infection control strategy to minimise nosocomial infection of coronavirus disease 2019 among ENT healthcare workers. 2020 The Journal of hospital infection, 104 (4), 454–455.	The document outlines Infection control measures established in the West China Hospital ENT department to protect HCWs and non-infected patients from potential COVID-19 patients.	Letter to the editor.	Setting up an infection control team to be in charge of infection control and prevention management; training on infection prevention measures; triage strategy; limiting traffic in the hospital; keeping the hospital environment clean; replacing local	Setting up infection control teams in healthcare facilities; training staff on infection prevention measures; employing triage strategy; limiting traffic in the healthcare facilities; keeping healthcare environment clean; wearing surgical masks.

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
China			anaesthetic spray with gel anaesthesia during laryngoscope examination; during nasal endoscopy, care to be taken to ensure adequate surface anaesthesia to reduce the sneeze reflex; wearing of surgical masks.	
WHO IPC during healthcare when COVID-19 is suspected or confirmed. 2021	This third edition of the WHO interim guidance on IPC during healthcare delivery in COVID-19 provides updated guidance to support	Interim Guidance in Infection on prevention and control during health care when COVID-19 is	Do triage for early recognition, and source control; apply standard precautions for all patients; transmission-based precautions (contact,	Screening and triage for early recognition and source control; applying standard and transmission-based precautions; provision of adequate staff training;

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
	safe healthcare through applying IPC procedures for the protection of patients, staff, caregivers, and visitors in healthcare settings.	suspected or confirmed.	droplet, and airborne prevention for aerosol-generating procedures); provision of adequate staff training; ensure an adequate patient-to-staff ratio; implement environmental and engineering controls; duration of contact and droplet precautions for COVID-19 patients. Monitoring HCWs compliance with standard precautions	ensuring an adequate patient-to-staff ratio; implementing environmental and engineering controls; monitoring of HCWs adherence to standard precautions; and providing mechanisms for improvement as needed.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			and providing mechanisms for improvement as needed.	
Health Protection Surveillance Centre Public Health & Infection Prevention & Control Guidelines on the Prevention and Management of Cases and Outbreaks of COVID-19, Influenza & other Respiratory Infections in Residential Care Facilities		Guideline	Wearing respirators or Filtering Face Piece (FFP2, FFP3), National Institute for Occupational Safety and Health(NIOSH)-approved N95); testing of symptomatic individuals; an adequate supply of PPE to ensure single -use of PPE; triaging	Wearing respirators and masks; testing of symptomatic individuals; adequate supply of PPE; educating all staff about respiratory etiquette and hand hygiene; safe management of linen and laundry; practical measures to ensure adequate ventilation.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
2023 Ireland			and educating all staff about respiratory etiquette and hand hygiene; safe management of linen and laundry; practical measures to ensure adequate ventilation.	
Ontario Agency for Health Protection and Promotion (Public Health Ontario), 2020 Best Practices for Prevention, Surveillance and Infection Control Management of Novel	This document displays interim best practices using a precautionary approach for the prevention, surveillance, and management of an outbreak of a novel	Guideline	Screening of staff, patients, and visitors entering the healthcare setting; posting applicable signage at the entrance of hospitals; ensuring hand hygiene practices;	Screening of all people entering the healthcare setting; ensuring hand hygiene practices; implementing airborne and droplet/contact precautions; using general infection prevention practices;

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Respiratory Infections in All Health Care Settings Toronto	respiratory infection in healthcare settings across the continuum of care.		implementing airborne and droplet/contact precautions; encouraging staff to adhere to infection prevention practices; staff members with symptoms of an acute respiratory infection must not come to work and must report symptoms to healthcare authorities; educating staff on respiratory infections.	educating staff on respiratory infections; focusing on characteristics of the disease, level of risk in the healthcare setting, the healthcare setting plan to respond to the infection; provide PPE.

Authors, title, year, journal, and country	**Study aim**	**Design, methods, setting, participants**	**Key study findings**	**Information to be used in drafting strategies**
National Health Service (NHS) 2022 Respiratory virus infections Including COVID-19: IPC Guidance United Kingdom	This document outlines the IPC advice for the Harrogate and District Foundation Trust (HDFT).	Guideline	Promote PCR testing, wearing masks and single-use PPE, and implement control precautions, including isolation practices.	PCR testing; wearing a fluid-repellent surgical mask; using PPE; standard infection control precautions; isolation practices.
Ministry of Health, Ghana 2020 COVID-19 Guidelines for Ghana Ghana	This provisional guideline recommends the management of COVID-19 patients.	Guideline	Early recognition and isolation of infected patients; implement an appropriate pre-triage and triage system; use of PPE for patients and staff; encourage optimal hand hygiene practices; promote	Early recognition and isolation; appropriate pre -triage and triage system; use of PPE for patients and staff; hand hygiene practices; environmental cleanliness and cleaning of surfaces according to IPC guidance; confirmed cases should be isolated.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			environmental cleanliness; confirmed cases should be isolated.	
Stempliuk. Valeska Prevention of healthcare -associated respiratory tract infections (HA-RTI) 2022		Presentation	Standard, droplet, airborne, and contact precautions; decontamination of patient care items and equipment; all items that come into direct or indirect contact with mucous membranes of the lower respiratory tract; Prefer oral intubation instead of nasal intubation for	Implement standard, droplet, airborne, and contact precautions; decontaminate all items that come into direct or indirect contact with mucous membranes of the lower respiratory tract of patients with infections; use oral intubation instead of nasal intubation for adults and adolescents; use a close suctioning

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			adults and adolescents; use a close suctioning system; periodically drain and discard condensate in the tubing; use a new ventilation circuit for each patient; change the circuit only if it is soiled or damaged; change heat moisture exchangers when soiled or every 5-7 days; ensure safe endotracheal suction practices.	system; periodically drain and discard condensate in the tubing; use a new ventilation circuit for each patient.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Department of Health, Republic of South Africa Practical Manual for Implementation of the National Infection Prevention and Control Strategic Framework 2020 South Africa	The manual is aimed at healthcare workers for implementation and governance of the IPC programme at health facilities.	Guideline	Practice hand hygiene; appropriate use of PPE, antiseptics, disinfectants, and detergents; decontamination of medical devices; safe handling of linen and laundry; healthcare waste management; advise respiratory hygiene and cough etiquette, environmental cleaning and principles of asepsis; do transmission-	Practice good hand hygiene; use PPE, antiseptics, disinfectants, and detergents; decontamination of medical devices; safe handling of linen and laundry; good healthcare waste management; advise patients and staff regarding respiratory hygiene and cough etiquette; ensure environmental cleaning and use principles of asepsis; implement transmission-based precaution; manage

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			based precaution; build environment and infrastructure for IPC; surveillance of healthcare-associated infections.	surveillance of healthcare-associated infections.
Shared health IPC Outbreak Management Guidelines Respiratory (Including Influenza and Covid-19) and Gastrointestinal 2023 Canada	This document provides best practice IPC guidelines for outbreak management of respiratory and gastrointestinal illness (GI) in acute and long-term care settings.	Guideline	Ensure IPC measures are implemented to prevent the spread of respiratory infections; vaccination; ensure health facilities have adequate supplies	Implement vaccination; ensure health facilities have adequate supplies during an outbreak; provide timely chemoprophylaxis.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			during an outbreak; and provide timely chemoprophylaxis.	
California Department of Public Health Preventing Respiratory Infections in Skilled Nursing Facilities 2021 United States of America		Training Manual	Vaccination; ensure adequate nutrition and hydration; perform hand hygiene; appropriate PPE for suctioning and cleaning respiratory equipment; reduce the duration of mechanical ventilation; prevent exposure to	Advocate for vaccination; promote the value of adequate nutrition and hydration; perform hand hygiene; use PPE for suctioning and cleaning respiratory equipment; reduce the duration of mechanical ventilation; prevent exposure to contaminated respiratory equipment; screening of patients and staff;

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			contaminated respiratory equipment; screening of patients and staff; respiratory hygiene and cough etiquette; transmission-based precautions; training of staff to improve competency to prevent respiratory infections; adopt an adherence monitoring programme for measuring preventing care practices.	promote respiratory hygiene and cough etiquette; implement transmission-based precautions; train staff to prevent respiratory infections; adopt an adherence monitoring programme for measuring preventing care practices.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
Public Health Agency Northern Ireland IPC Measures for Respiratory illnesses 2023 Ireland		Guideline	Triaging and testing for respiratory infections; wearing of masks; surveillance and monitoring/outbreak management and reporting in an inpatient setting; appropriate PPE for providing direct care; isolation recommended when necessary.	Testing for respiratory infections; wearing of masks; doing surveillance and managing outbreaks; using PPE for providing direct care for patients with suspected/confirmed respiratory illnesses; implementing isolation measures if necessary.
Public Health Agency of Canada Reduce the spread of respiratory viruses		Webpage information	Get your annual flu shot; stay up to date with your COVID-19 vaccinations; stay	Use vaccination; recommend that staff stay home when ill; encourage using well-

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
2023 Canada			home when ill; properly wear a well-fitting mask in public indoor settings; improve indoor ventilation when possible by opening windows or doors; implement good hand and respiratory hygiene.	fitting masks when necessary; improve indoor ventilation when possible, by opening windows or doors; support good hand and respiratory hygiene.
Taylor, M. CDC Publishes Ventilation guidance for respiratory infections 2023 United States of America		webpage information	Maintain the Heating, ventilation, and air conditioning (HVAC) system regularly and according to manufacturer recommendations;	Ensure adequate ventilation in healthcare facilities.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
			open windows and doors and use exhaust fans to bring clean outdoor air in.	
HEPACART Healthcare-Associated Infections 2021 United States of America	The document aimed to outline strategies for preventing healthcare-associated infections through four best practices.	webpage information	Implement good hand and respiratory hygiene, use PPE, and ensure environmental hygiene to prevent healthcare-associated infections.	Implement good hand and respiratory hygiene, use PPE, and ensure good environmental hygiene.
WHO Healthcare-associated infections Fact sheet 2020	WHO Patient Safety is working towards establishing effective ways of improving global healthcare and saving lives lost to	Fact sheet	Identifying local determinants of the infection; implementing reporting and	Implement standard precautions, particularly best hand hygiene practices at the bedside; improving staff education.

Authors, title, year, journal, and country	Study aim	Design, methods, setting, participants	Key study findings	Information to be used in drafting strategies
	healthcare-associated infections by assisting with the assessment, planning, and implementation of IPC policies and timely actions at national and institutional levels.		surveillance systems; ensuring facilities and dedicated resources; implementing infection control and standard precautions, particularly best hand hygiene practices at the bedside; improving staff education.	

4.3.1 Findings of the analysis of the literature review

The researcher used a thematic analysis to analyse the summary of the data extracted from the selected papers. Studying the focus of the documents, the researcher searched for common patterns among them, answering the research question.

Ten main themes (Table 4.2), essential for preventing the healthcare-associated spread of respiratory infections, emerged from the analysis:

- Ensuring triage, early recognition, and source control
- Apply standard and transmission-based precaution
- Education and training of healthcare workers
- Engineering controls
- Active surveillance programme for staff, visitors, and patients with acute respiratory infections
- Restriction of visitors and caregivers
- Vaccination of HCWs as recommended by the WHO/MOH
- Promoting healthy behaviours to strengthen the immune system
- Adequate supply of PPE
- Monitoring and evaluation and investing in research

Table 4.2: Documents sorted in Themes (X= study included under that theme)

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
Ahmad et al. 2022		X	X							
Alqahtani et al. 2022		X		X			X	X		
Alsaedi et al., 2022		X		X	X	X				
Anguraj et al. 2021		X								X
Badr et al. 2021			X	X						
Bludau et al. 2022		X	X	X		X				
Burdsall, 2020		X			X		X	X		X
		X		X				X		

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
Calcagni et al. 2023										
Candevir et al. 2021		X								
Chadsuthi & Modchang 2021				X			X			
Cheng et al. 2021	X	X			X		X			
Lim et al. 2022		X		X	X				X	
Crnich 2022		X	X							X
		X	X	X			X			X

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
European Centre for Disease Prevention and Control 2023										
Glowicz et al. 2023		X	X						X	X
Hutchinson et al. 2020		X		X						
Jang et al. 2022	X	X	X		X	X				
Karam et al. 2021		X							X	
Kitt et al. 2023	X	X	X		X					

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
Li et al. 2021		X		X						
Di Cola et al. 2023		X				X			X	
de Miranda Costa et al. 2020		X	X		X					X
Mouallem et al. 2021			X						X	
Negera et al. 2022		X	X				X		X	
Ochie et al. 2022			X							
Osula et al. 2022			X							
		X								

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
Sandaradura et al. 2020										
Tarshkandi et al. 2021	X	X		X	X				X	X
Thibon et al. 2021	X	X		X			X			
Vicentini et al. 2023							X			
Vimercati et al. 2020		X	X	X						
Lee et al. 2020			X	X		X				

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
Wee et al. 2021		X		X	X					X
Wilson et al. 2022		X		X			X			X
Winkler et al. 2022		X		X	X	X	X		X	
Lu et al. 2020	X	X	X	X						
WHO, 2021	X	X	X	X		X	X			X
Health Protection Surveillance Centre, 2023	X	X		X	X		X		X	
Ontario, 2020		X	X	X	X				X	X
		X		X	X			X		

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
National Health Service (NHS) 2022										
Ministry of Health, Ghana 2020	X	X		X						
Stempliuk, 2022		X		X						
Department of Health, RSA 2020		X	X	X	X					X
Shared health 2023		X				X	X	X	X	

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
California Department of Public Health 2021		X	X				X	X		X
Public Health Agency Northern Ireland 2023	X	X		X	X					X
Public Health Agency of Canada 2023		X	X	X			X			
Taylor, 2023				X						

Articles	Ensuring triage, early recognition, and source control	Apply standard and transmission-based precaution	Education and training of healthcare workers	Engineering controls	Active surveillance programme for staff, visitors, and patients with acute respiratory infection	Restriction of visitors and caregivers	Vaccination of HCWs as recommended by the WHO/MOH	Promoting healthy behaviours to strengthen the immune system	Adequate supply of PPE	Monitoring and evaluation and investing in research
HEPACART 2021		X								
WHO 2020g		X	X		X				X	X
Number of Articles	10	42	22	28	16	8	15	6	12	15

4.3.1.1 Theme 1: Ensuring triage, early recognition, and source control

Ten articles were used to draft strategy to ensure triage, early recognition, and source control to prevent the spread of respiratory infections in healthcare facilities. It is essential to pre-triage all potential patients with fever and cough and to provide them with surgical masks. They should also be kept from crowded environments and, when possible, kept in isolation (WHO, 2021:6). According to Lu et al. (2020:454), adequate triaging and proper bed allocation of patients with respiratory infections may reduce the spread of the infections in healthcare facilities. A detailed triage at the emergency room and all hospital entrances should be initiated as part of measures to stop respiratory viral transmission from the community to hospitals (Cheng et al., 2021:9; MOH,2020:20). Screening clinics for the early diagnosis and treatment of respiratory infections should be instituted at hospitals (Jang et al., 2022:24) and screening checkpoints at hospital entrances for Acute Respiratory infections (Tarshkandi et al., 2021:454; Public Health Agency Northern Ireland 2023:15; Health Protection Surveillance Centre, 2023:15) may contribute to the prevention of the spread of infections. The screening of visitors of hospital patients for respiratory infections should also not be neglected (Kitt et al., 2023:1).

4.3.1.2 Theme 2: Apply standard and transmission-based precautions

Forty-two articles were used in drafting the strategy that refer to applying standard and transmission-based precautions to reduce the spread of respiratory infections in healthcare facilities. Effective hand hygiene practices should be encouraged among healthcare workers, patients, and visitors to prevent healthcare-associated respiratory infections (Burdsall, 2020:15; Alqahtani et al., 2022:10; WHO, 2020g:4). The practices need to be emphasised not only during patient care but also during gatherings in all healthcare facilities (Alsaedi et al., 2022:7). It is crucial to promote the maintenance of healthy hand skin and fingernails by encouraging staff to include fingernail care (Glowicz et al., 2023:367-369).

Using recommended PPE by healthcare workers, patients, caregivers, and persons in the healthcare setting may contribute to the prevention of the spread of respiratory infections (Bludau et al., 2022:33; Alqahtani et al., 2022:10; MOH,2020:20; Di Cola et al., 2023:3). The equipment may mitigate potential indirect contact transmission of respiratory infections by reducing environmental surface contamination and providing barrier protection (Wilson et al., 2022:323). Healthcare workers managing patients with respiratory infections in high-risk areas or performing aerosol-generating procedures should put on a complete set of personal protection equipment, including an N95 mask or equivalent, gown, gloves, and eye protection (Lim et al., 2022:140).

Healthcare workers working in overcrowded settings or poorly ventilated areas should also wear a well-constructed, well-fitting mask (Public Health Agency Canada, 2023:1). Using N95 masks protects healthcare workers remarkably from viral respiratory infections (Candevir et al., 2021:3241). When disposable particulate respirators are used, a seal check must be conducted to ensure no leaks. An appropriate respirator fit may be compromised by a beard or other thick facial hair (Sandaradura et al., 2020:1; WHO, 2021:9). The WHO recommends that although COVID-19 infections are no longer rife, all healthcare workers should still continuously use medical marks during patient care. Under this, all healthcare workers, including community health workers and caregivers who work in clinical settings, must wear medical masks throughout their entire shifts, except for when eating or drinking and when they change their masks after attending to a patient who needs droplet/contact or airborne precautions for reasons other than COVID-19 infections (WHO, 2021:7).

Regular cleaning and disinfection of respiratory equipment, high-touch surfaces, and objects that had been used during patient care can reduce the spread of healthcare-associated respiratory infections (Public Health Agency of Canada, 2023:1; California Department of Public Health, 2021:18; European Centre for Disease Prevention and Control [ECDC], 2023:8; Winkler et al., 2022:5). All items that come into direct or indirect contact with the mucous membranes of the lower respiratory tract of patient should be decontaminated after use (Stempliuk, 2022:28).

Adequate environmental cleaning and disinfection of rooms in the healthcare facility can prevent the spread of respiratory infections (Lu et al., 2020:454; Vimercati et al., 2020:2; MOH, 2020:20; Wee et al., 2021:129; Wilson et al., 2022:323). Healthcare workers and patients must ensure good respiratory hygiene and cough etiquette by covering their cough and sneezes with a tissue or by using bend elbows (Public Health Agency Canada, 2023:1; California Department of Public Health, 2021:18; HEPACART, 2021:1; Calcagni et al., 2023:61).

A standard operating procedure for the management of linen should be implemented in all healthcare settings (Department of Health, South Africa, 2020:69; Health Protection Surveillance Centre, 2023:39). Staff members should be trained and assigned to control laundry and must ensure that all applicable measures are followed to prevent the spread of respiratory infections (Department of Health, South Africa, 2020:69).

Transmission-based precautions include contact precautions and droplet and airborne precautions for aerosol-generating medical procedures (Ontario, 2020:18; Stempliuk, 2022:26-27; Department of Health, Republic of South Africa, 2020:28). If necessary, additional precautions to prevent the spread of respiratory infections should be implemented based on research evidence. Droplet precautions to prevent the spread of drops of secretions contaminated with bacteria and viruses and contact precautions to avert direct or indirect transmission by avoiding contact with infected surfaces or devices are necessary. Healthcare workers should use proper PPE (medical mask, eye protection, gloves, and gown) and sanitised equipment during patient care. They should avoid contacting their mouth, nose, or eyes with potentially infected gloves or ungloved hands. It is also essential to avoid contaminating areas of the surroundings (such as door handles and light switches) not specifically used in patient care. Good hand hygiene before and after removing PPE should be practised (WHO, 2021:9).

Healthcare workers who perform aerosol-generating procedures (such as intubations, bronchoscopies, open suctioning of the respiratory tract, and cardiopulmonary resuscitation) are exposed to airborne infections and should, therefore, wear PPE, which should include gloves, long-sleeved gowns, eye protection, and fit-tested particulate respirators (N95 or equivalent, or higher level of protection). A user-performed seal check before each user should not be mistaken for a planned fit test. Such procedures should be performed in well-ventilated rooms (WHO, 2021:9).

4.3.1.3 Theme 3: Education and training of healthcare workers

To prevent the spread of respiratory infections, upscaling the knowledge and skills of all staff members is crucial (WHO, 2020g:4). Successful training of healthcare workers can reduce the prevalence and spread of healthcare-associated infections with a significant decrease in institutional healthcare expenses (Department of Health, Republic of South Africa, 2020:175). Such training should be complemented with applicable administrative measures to enable staff to use their knowledge and skills to the benefit of themselves and their patients (Ochie et al., 2022:6).

Twenty-two studies were used to draft strategies to prevent the spread of healthcare-associated respiratory infections through education and training of healthcare workers. The workers should be trained regarding the correct donning and discarding of personal preventive equipment (Vimercati et al., 2020:2) and about ways to prevent interpersonal spread of viruses and bacteria (Lee et al., 2020:2; ECDC, 2023:8; Crnich, 2022:1912; Ahmad et al., 2022:4) followed by refresher courses to ensure their competency in infection prevention (Negera et al., 2022:9). It is essential to arrange periodic training for all staff of ICU and for all hospital cleaning staff (Lu et al., 2020:454; de Miranda Costa et al., 2020:27; Osula et al., 2022:4). All pre-entry training of healthcare professionals should include basic measures to prevent the spread of infections (Mouallem et al., 2021:57; Department of Health, Republic of South Africa, 2020:175). The focus of all infection prevention training should be on the characteristics of infections, the level of risk of infection in the healthcare setting, and measures to respond to infections (Ontario, 2020:18; WHO, 2021:10). Healthcare workers need to know how to use alcohol-based hand sanitisers properly (Glowicz et al., 2023:368). According to Crnich (2022:1912), each healthcare facility requires the input from infection control specialists with advanced training in infection management with an emphasis on preventing infections (Crnich, 2022:1912).

Public health campaigns that emphasise individual risk and provide clear, consistent guidance on what individuals can do to decrease their risk for respiratory infections may be effective in motivating people to prevent infection and adhere to measures to manage infections (Badr et al., 2021:677). Patients and caregivers must be educated to prevent and manage respiratory infections. It can be conducted through the dissemination of educational materials, such as banners, posters, and brochures on preventive measures (Jang et al., 2022:24; Bludau et al., 2022:33; Kitt et al., 2023:359; de Miranda Costa et al., 2020:26).

4.3.1.4 Theme 4: Engineering controls

Engineering controls are an integral part of IPC and include standards for adequate ventilation of high-risk areas in healthcare facilities, proper structural design, and spatial separation between infected and non-infected patients (WHO, 2021:11). A variety of engineering controls have been recommended to reduce the risk of respiratory infection transmission in healthcare settings**.** Twenty-eight studies were used to draft strategies to prevent the healthcare-associated spread of respiratory infections through engineering controls.

The buildings of healthcare facilities should be designed to be airy, of the right temperature and humidity, and allow workflow activities to prevent the spread of infections through the air to patients, visitors, and healthcare workers. Healthcare facilities should be designed, furnished, and supplied with materials and finishes that are easy to clean to reduce the spread of infectious diseases.

The structure of wards and isolation rooms should have an-suite ablution facilities and overcrowding should be prevented at all times (Department of Health, Republic of South Africa, 2020:34: Health Protection Surveillance Centre, 2022:39; Vimercati et al., 2020:2; Taylor, 2023:1; ECDC, 2023:8; Public Health Agency of Canada, 2023:1). When necessary, infected patients should be cared for in negative-pressure airborne infection-isolation-rooms to prevent the spread of their infections to other patients (Wee et al., 2021:125; Ontario Agency for Health Protection and Promotion, 2020:19; Public Health Agency Northern Ireland, 2023:48; MOH, 2020:20; National Health Srevice, 2022:19; Tarshkandi et al., 2021:1156; Li et al., 2021:5; Hutchinson et al., 2020:121).

A reduction in the duration of mechanical ventilation can also prevent healthcare-associated respiratory infections (California Department of Public Health, 2021:15). Appropriate ventilation and air filtration of patient care spaces are essential to prevent infection, reduce contamination, and decrease the number of infectious particles through air exchanges, occupancy, and cycling time between patient use (Winkler et al., 2022:312). A new ventilator circuit should be provided to each patient, and the circuit can be changed only when soiled or damaged to prevent ventilator-acquire pneumonia (Stempliuk, 2022:41). Ventilation and filtration of air and physical distancing between source and receptors are categorised under pathway intervention strategies. Adequate ventilation reduces the transmission of respiratory infections (Wilson et al., 2022:320).

An outdoor pharmacy service for regular maintenance prescriptions may contribute to the prevention of the spread of infections (Lee et al., 2020:2). Social distancing of at least 1.5

metres for infected and non-infected persons may also contribute to the prevention of the spread of respiratory infections in healthcare settings (Badr et al., 2021:679-680; Calcagni et al., 2023:57). Social distancing as a control measure for respiratory infection outbreaks must be kept in place in all healthcare settings during episodes (Alsaedi et al., 2022:1284; Thibon et al., 2021:6). According to Alqahtani et al., (2022:6-7) citizens are more willing to use social distancing measures indoors than outdoors during respiratory infection outbreaks. In clinics and workplaces, social distancing can be implemented by keeping one or two chairs empty in waiting areas (Bludau et al., 2022:31). Physical distancing between people is a measure that can easily be implemented to prevent the spread of respiratory infections (Wilson et al., 2022:320-321); however, Chadsuthi and Modchang (2021:6) observe that physical distancing only helps delay the peak of the outbreak of respiratory infections.

4.3.1.5 Theme 5: Active surveillance programme for staff, visitors, and patients with acute respiratory infections

Surveillance of infections is the systematic collection, analysis, and interpretation of data on the disease frequency. It is essential to the planning, implementation, and evaluation of public health practices and the timely dissemination of the data for public health action**.** Healthcare-associated respiratory infections can be reduced by successfully implementing infection prevention measures in healthcare facilities (Department of Health, Republic of South Africa, 2020:138). The initial infection control measure for respiratory disease outbreaks includes screening of all healthcare workers and patients with respiratory symptoms (Winkler et al., 2022:313; Alsaedi et al., 2022:1283; Cheng et al., 2021:9). Regular monitoring of respiratory symptoms of caregivers and visitors should also be conducted (Jang et al., 2022:24; Kitt et al., 2023:359; Public Health Agency Northern Ireland, 2023:6).

One of the safety measures implemented by nursing leadership during pandemics should include the screening of all staff at the beginning of the shift for signs of acute respiratory infections (Tarshkandi et al., 2021:1156: National Health Service, 2022:5). Anyone who screens positive for a respiratory infection needs to be instructed to implement precautions and be referred for medical assessment (Ontario Agency for Health Protection and Promotion, 2020:11-12). Hospital-wide enhanced staff sickness surveillance is necessary and needs to be implemented in addition to routine staff sickness absenteeism surveillance to identify infected staff early and to prevent nosocomial transmission to other staff members (Lim et al., 2022:141). Ill healthcare workers should be requested to report to the staff clinic for further investigation and positioned on a mandatory 5-day medical leave (Wee et al., 2021:126).

For ongoing healthcare-associated respiratory infections surveillance, initial point prevalence studies should be conducted to establish baseline information**.** Sixteen articles obtained in the literature search were used to draft strategies for preventing the spread of respiratory infection in a healthcare setting through active surveillance programmes for healthcare workers, visitors, and patients with respiratory infections/illnesses.

4.3.1.6 Theme 6: Restriction of visitors and caregivers

Eight documents were used to draft strategies to prevent the healthcare-associated spread of respiratory infections by restricting visitors and caregivers during an outbreak. The restriction of visitors may contribute to preventing the spread of respiratory infections (WHO, 2021:10; Di Cola et al., 2023:3; Alsaedi et al., 2022:1284). It may also be necessary to restrict the number of caregivers to visit hospitalised patients (Shared Health, 2023:7). Hospitals with paediatric units usually allow only one accompanying person for underage patients (Bludau et al., 2022:33) and a total restriction on visitation to ICU and special wards during respiratory infection outbreaks (Jang et al., 2022:24). Other workflow modifications to ensure the reduction of the spread of respiratory infections may be to reduce room entry and exit in caring for patients exposed to or with suspected infections (Winkler et al., 2022:313). A visitor policy, including maintaining a visitor log and limiting visitor numbers, is often required during respiratory infection outbreaks. Access control is essential to avoid overcrowding in healthcare facilities during an outbreak of respiratory infections; only those hospital entrances essential to the effective movement of personnel can be kept open (Lee et al., 2020:103).

4.3.1.7 Theme 7: Vaccination of healthcare workers as recommended by WHO/MOH

The most reliable method of preventing healthcare workers from acquiring respiratory infections is vaccination (Wilson et al., 2022:321). Vaccination against respiratory infections is vital to protect healthcare workers and the people they care for (Health Protection Surveillance Centre, 2023:12). When healthcare workers are vaccinated, they contribute to the prevention of respiratory disease outbreaks (WHO, 2021:23). Mandatory vaccination for all healthcare workers against respiratory viruses/infection reduces the spread of infections in healthcare settings (Thibon et al., 2021:6; Vicentini et al., 2023:52). A crucial element of managing respiratory infections and safeguarding healthcare workers is providing high coverage with safe and efficient vaccines. This is in addition to following recommended infection control and prevention practices (Cheng et al., 2021:13; Negera et al., 2022:9).

According to Alqahtani et al. (2022:6) and Chadsuthi and Modchang (2021:8), vaccination, as recommended by the WHO, is a reliable measure to control respiratory infections. Immunisation with the influenza, COVID-19 and Pneumococcal vaccines is the most effective way to prevent respiratory diseases and complications (Shared Health, 2023:16; California Department of Public Health, 2021:6). Healthcare workers should, therefore, be advised on and offered vaccination against influenza and SARS-COV-2 under national recommendations (ECDC, 2023:8). High-dose vaccine demonstrated that influenza vaccination has a vital protection effect when compared to standard-dose vaccine (Burdsall, 2020:15). Vaccination has been added as an elimination strategy for respiratory pandemics, in that several employers, including healthcare organisations, made employee vaccination a condition of employment. The approach has been supported by several professional societies and organisations (Winkler et al., 2022:313). Fifteen studies were used to draft strategies to prevent the healthcare-associated spread of respiratory infections through recommended vaccination/immunisation.

4.3.1.8 Theme 8: Promoting healthy behaviours to strengthen the immune system

The immune system's biochemical and communication pathways may be supported by optimal hydration (Lukito, 2021:3). The provision of proper amounts of nutrients to immune cells through adequate nutrition is crucial for regulating an optimal immune response (Munteanu & Schwartz, 2022:1). The exchange of immunological cells between the circulation and peripheral lymphoid tissues is improved by regular bouts of moderate-to-vigorous exercise. The result is improved immune system, better health, and a reduced risk of infection (Simpson et al., 2020:6).

Six articles from the review were used to draft strategies to prevent the healthcare-associated spread of respiratory infections by promoting healthy behaviours to strengthen the immunity of healthcare workers, patients, and the public. Healthcare workers discourse behavioural measures, such as smoking cessation and exercise, to enhance immunity (California Department of Public Health, 2023:10; Calcagni et al., 2023:57). Modifiable risk factors for pneumonia should be discoursed, such as smoking cessation, alcohol, and drug abuse. Adequate nutrition also decreases the risk of pneumonia (Burdsall, 2020:15). Smoking cessation protects an individual from respiratory diseases (National Health Service, 2022:1). Despite smokers being more susceptible to respiratory infections, smokers are often reluctant to stop their smoking habit. For future implementation, special consideration should be paid to the potential harms of smoking (Alqahtani et al., 2022:10). The management of these problems needs an interdisciplinary approach (Burdsall, 2020:15).

4.3.1.9 Theme 9: Adequate supply of personal protection equipment

The prevention of the spread of respiratory infections requires that all healthcare facilities should have an adequate supply of PPE to protect their healthcare workers from infections (Ontario Agency for Health Protection and Promotion, 2020:18) and spreading it to their colleagues, patients and visitors (Health Protection Surveillance Centre, 2023:39; Shared Health, 2023:20). It forms part of the minimum requirements for infection control in healthcare settings (WHO 2020g:4; Glowicz et al., 2023:362). The provision of the equipment is part of standard and transmission-based precautions (Winkler et al., 2022:313; Di Cola et al., 2023:3). The healthcare setting needs to manage resources safely and effectively during outbreaks of respiratory infections to enable an adequate supply of the equipment (Tarshkandi et al., 2021:1157).

In focus on reducing nosocomial infection between patients and healthcare workers, continuous provision of PPE for all healthcare workers is essential (Negera et al., 2022:9). Reusable equipment is cheaper than disposable equipment and provides adequate protection to patients, caregivers, and healthcare workers (Mouallem et al., 2021:56-57). An adequate equipment supply can mitigate respiratory infections (Karam et al., 2021:4). Staff working in high-risk areas or performing aerosol procedures should have suitable equipment (Lim et al., 2022:140). Twelve studies were used to draft strategies to prevent the healthcare-associated spread of respiratory infections through an adequate supply of PPE.

4.3.1.10 Theme 10: Monitoring and evaluation, and investing in research

Healthcare facilities must adopt an adherence monitoring programme for measuring preventive care practices (California Department of Public Health, 2021:36). Regular feedback to the healthcare managers promotes best practices and, over time, causes behaviour or system change towards improving the quality of care and patient safety is obtained (Department of Health, Republic of South Africa, 2020:186). Hand hygiene audits must be conducted through regular monitoring of hand hygiene adherence by staff (Wee et al., 2021:129; Anguraj et al., 2021:1248-1251; de Miranda Costa et al., 2020:27; Glowicz et al., 2023:369). Ensure an ongoing healthcare facility risk assessment and an associated infection prevention programme (Burdsall, 2020:15). It is, however, insufficient to monitor workplace risks; measures to reduce the risks need to be developed and implemented (ECDC, 2023:8) as healthcare workers in acute settings are often exposed to developing respiratory infections (Wilson et al. 2022:312).

The WHO developed several devices for healthcare facilities and public health stakeholders to assess the preparedness of facilities to identify and manage COVID-19 patients and other respiratory infections and monitor and evaluate measures to prevent the spread of respiratory infections (WHO, 2021:16). Risk assessment must be conducted in all healthcare settings by a competent person with the skills, knowledge, and experience to recognise the hazards associated with respiratory infectious agents (Public Health Agency Northern Ireland, 2023:3). Provision of support and supervision of staff during outbreaks of respiratory infection are required (Ontario Agency for Health Protection and Promotion, 2020:18). The monitoring of staff well-being, establishing mental health support, and giving financial incentives can prevent negative attitudes towards preventing respiratory infections during outbreaks (Tarshkandi et al., 2021:1158).

Governmental and non-governmental organisations should fund research to create more efficient vaccines and chemoprophylaxis/treatments for respiratory tract diseases (Crnich, 2022:1912). Research should be conducted to adapt and validate surveillance protocols based on the reality of all countries, developing, and developed (WHO, 2020g:4). Fifteen articles were used to draft strategies to prevent the healthcare-associated spread of respiratory infections through monitoring and evaluation.

4.4 Drafting of the strategy to prevent the healthcare-associated spread of respiratory infections

The themes emerging from the review were used to draft the strategy for preventing the healthcare-associated spread of respiratory infections among healthcare workers. Each theme relates to a strategy and is substantiated by a rationale and supported by a set of actions. The rationale and the efforts were derived from the findings of the cross-sectional research conducted in Phase 1 of the study and the outcome of the scoping review undertaken in Phase 2. As the KAP theory and the HBM structured the findings of Phase 1, the researcher used the same theory and model to structure the strategy. The drafted strategy was compiled to meet the criterion of the AGREE device (Brouwers et al., 2017:7). These aspects are solicited:

1. **Scope and purpose of the strategy**: The objectives of the strategy and the target population are described in the preamble of the strategy.
2. **Stakeholder involvement in developing the strategy:** The target users of the strategy were defined in the preamble of the strategy.
3. **The rigour of strategy development:** Systematic methods were used to search for evidence. A scoping review using the JBI methodological framework for scoping reviews was used to explore and analyse the literature. The findings of a cross-sectional study to determine the KAP of Ghanaian healthcare workers were integrated with the literature in the drafting of the strategy. It is briefly described in the preamble of the strategy.
4. **Clarity and presentation of the strategy:** The rationale and actions of the strategy were presented.
5. **Applicability of the strategy:** The strategies advise on how the actions can be put.

6. **The editorial independence of the strategy**: This aspect is not applicable as it discourses the potential competing interests of funding bodies. The researcher did no use funding from organisations to execute the research and development of the strategy.

4.5 Strategies drafted from the findings of Phases 1 and 2 of the study

The following strategy was constructed to prevent the healthcare-associated spread of respiratory infections.

Preamble of the strategies

Healthcare-associated infections constitute a major public health concern. Health systems' costs rise because of prolonged hospitalisation caused by infections, which often and significantly impair patients' life quality. Respiratory infections significantly increase the number of patients in healthcare services. Healthcare-associated respiratory infections absent at the time of admission of patients often aggravate already overburdened hospitals and clinics. There are numerous ways respiratory diseases spread in healthcare services, including airborne, droplet, and direct contact. The transmission routes depend on the pathogen and environmental factors.

To discourse this public health concern, the researcher conducted a cross-sectional study on 373 healthcare workers in Ghana to assess their KAPs towards preventing respiratory infections in healthcare services. A divergence in the healthcare workers' preventive practices towards COVID-19 and other respiratory infections was identified, suggesting that interventions should go far beyond just knowledge and attitude; however, strategies should be developed to prevent the healthcare-associated spread of COVID-19 and other respiratory infections.

The study findings were used as search terms in an extensive literature review, employing the Joanna Briggs Institute methodological framework for scoping reviews. The review's outcome, combined with the findings of the cross-sectional study, were used to draft strategies to prevent the healthcare-associated spread of respiratory infections. The concepts of the HBM and the KAP theory were used to structure the strategy. The drafted guidelines meet the criterion of the AGREE instrument. The current phase of the study aimed to refine the drafted strategies to prevent healthcare-associated respiratory infections.

Scope and purpose of the strategy: The strategies focus on practices that healthcare workers can adopt to prevent the healthcare-associated spread of respiratory infections.

Stakeholder involvement in developing the strategy: Nurses and all other members of the healthcare team are the target users of the strategy. They were represented in the first phase of the study to obtain baseline information for developing the guidelines and are in this phase of the study involved in refining the drafted strategies.

Rigour of development of the guidelines: Systematic methods were used to search for evidence. A scoping review using the Joanna Briggs Institute methodological framework for scoping reviews was used to explore and analyse the literature. The search words for the literature search were identified in the findings of the cross-sectional study on 373 healthcare workers in Ghana to assess their KAPs towards preventing respiratory infections in healthcare services. A thematic analysis of the outcome of the literature review was conducted, and 10 themes emerged. Each theme represents a strategy.

The clarity of presentation and applicability of the guidelines will be explored and described during the refinement of the strategy. Each strategy has a rationale and actions to be taken by the target user.

Application of the HBM and the KAP theory in the draft strategies

Healthcare workers' knowledge, attitudes and practices should be discoursed in preventing the spread of healthcare-associated respiratory infections. Knowledgeable healthcare workers may not have a positive attitude towards preventing the spread of healthcare-associated respiratory infections and may, therefore, not practice preventive measures. The strategies, therefore, address not only the knowledge of the workers to prevent the spread of infections, but also their attitude towards and their practice of preventive measures.

The core of the HBM rests on the opinions of people that they are susceptible to illnesses and that they can change their behaviour to prevent illnesses. The opinions are influenced by socio-demographic and psychosocial components. In developing the strategy to induce desirable health behaviour, healthcare workers' opinions about preventing respiratory infections apply.

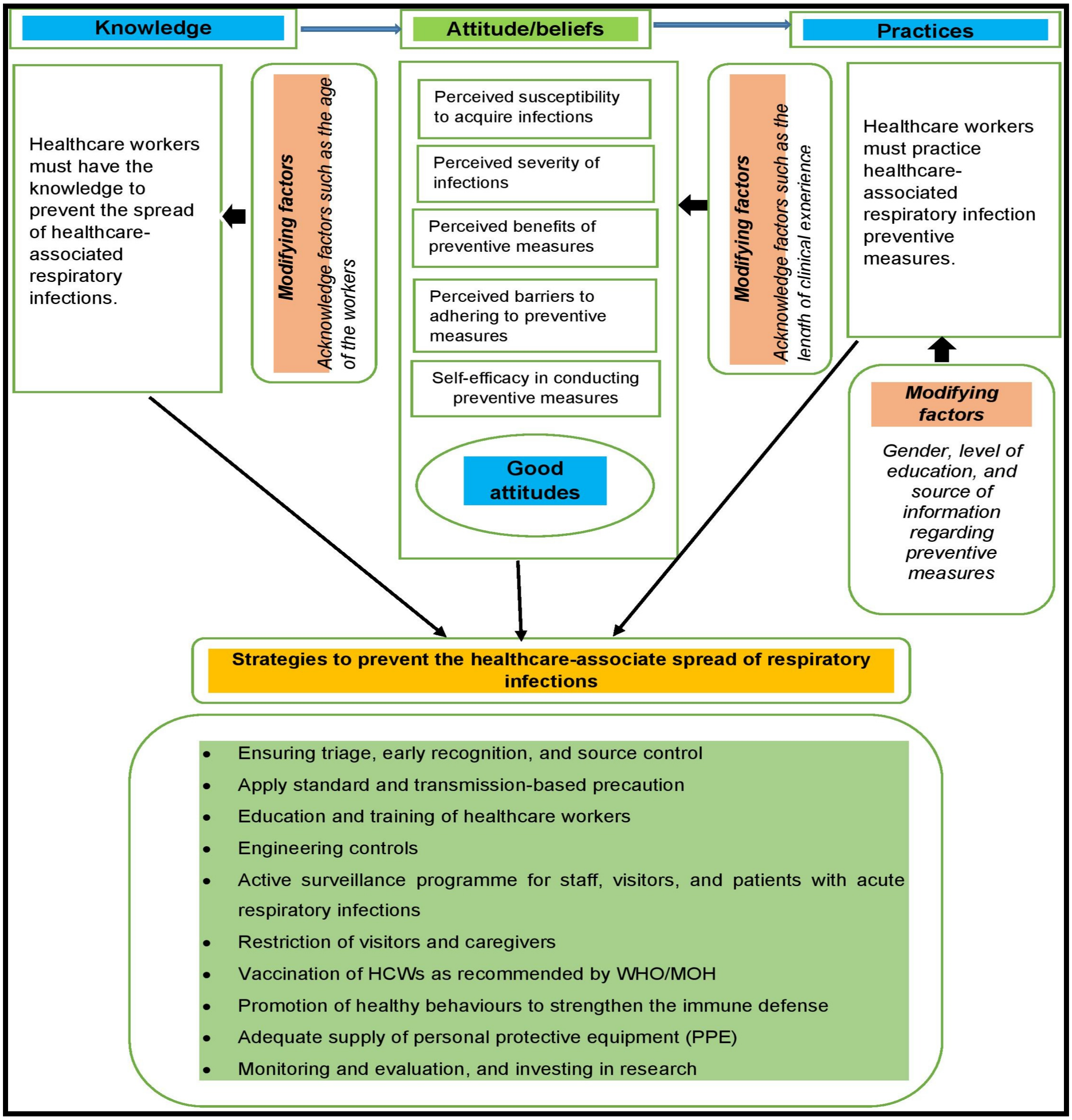


Figure 4.2: Framework for the strategy to prevent the healthcare-associated spread of respiratory infections based on the health belief model and the knowledge, attitude, and practice theory

Strategy 1: Healthcare workers must ensure triage, early recognition, and source control with suspected respiratory infections.

Rationale: Respiratory symptoms are the most common complaint in healthcare services. These symptoms can resolve without treatment, but they can also indicate a severe illness (Ellertsson et al., 2023:1). Respiratory infections can spread within the healthcare service if not promptly detected. Early screening and triaging of patients with acute respiratory symptoms should be of medical priority (WHO 2021:5). Triaging patients before in-person consultation would help to reduce the spread of respiratory infections among healthcare workers, visitors, and other patients in the healthcare service (WHO 2021:5). Appropriate triaging and bed allocation may reduce the rate of infections (Thibon et al., 2021:6).

Actions:

When ensuring triage, early recognition, and source control, Healthcare workers should:

- Be trained to recognise the signs and symptoms of respiratory infections
- Display information at the entrance of the healthcare service directing patients with signs and symptoms of acute respiratory infections to report for screening
- Be encouraged to be alert to any respiratory infection outbreak in all patients visiting the service
- Pre-triage all patients with cough and fever and provide a surgical mask
- Wear appropriate PPE and perform regular hand hygiene during the screening of patients
- Use standardised and validated triage devices to identify individuals needing immediate care and those who can safely wait while triaging other patients
- Encourage all patients with acute respiratory symptoms to wear masks in the waiting area of the healthcare service

- Ensure early testing for respiratory infections

Strategy 2: Apply standard and transmission-based precautions

Standard precautions

Rationale: Standard precautions aim to reduce the risk of transmission of blood-borne and other pathogens from recognised and unrecognised sources and are the basic level of interpersonal care precautions that should always be used in the care of all patients. Standard precautions refer to good hand hygiene practices, appropriate use of personal protection equipment, good respiratory hygiene, optimal cough etiquette, exquisite environmental cleaning and disinfection, safe handling of linen and laundry, and careful waste management (WHO 2021:5).

Properly using recommended PPE by healthcare workers, patients, caregivers, or persons in the healthcare setting prevents the spread of respiratory infections (Bludau et al., 2022:33; Alqahtani et al., 2022:10).

Actions

When ensuring hand hygiene, healthcare workers should:

- Wash hands before and after touching a patient, before and after a procedure or body fluid exposure, and after touching a patient's surroundings
- Clean hands with alcohol-based sanitiser containing 60-80% alcohol or with soap, water, and disposable towels
- Keep fingernails short and ensure healthy hand skin

When ensuring the appropriate use of PPE, healthcare workers should:

- Perform a risk assessment before encountering patients to determine whether using PPE is required
- Be trained on donning and discarding PPE and the scientific basis for the recommendations about protective practices
- Put on a complete set of PPE (N95 Mask, gown, gloves, and eye protection), when managing patients with respiratory infections in high-risk areas
- Have prompt access to the recommended PPE
- Perform a fit test and seal check when using the N95 mask
- Ensure proper respirator fit by shaving their beard or thick facial hair
- Remove PPE before leaving the area
- Perform hand hygiene immediately after removing PPE

When ensuring respiratory hygiene practices:

- Post signs at entrances with instructions to staff, patients, and individuals with symptoms of respiratory infections to:

    i. Wear masks when necessary.
    ii. Cough and/or sneeze in a bent elbow or into a disposable tissue and dispose of it immediately in a bin.
    iii. Perform hand hygiene afterwards

- Provide tissue and no-touch bins for disposal of tissues
- Provide masks to coughing patients and other persons with respiratory infections

When ensuring a clean environment, healthcare workers should:

- Ensure the cleaning of patients’ environment, surfaces, medical devices used, and other equipment with water and recommended detergents

- Ensure that the laundry and the management of linen are completed by safe routine procedures
- Ensure that recommended measures manage medical waste

Transmission-based precautions

In addition to standard precautions, all individuals should use contact and droplet precautions before entering a room with patients with suspected or confirmed respiratory diseases. Aerosol-generating procedures have been associated with an increased risk of transmission of respiratory viruses; therefore, the WHO recommends special airborne precautions when performing these procedures (WHO 2021:9). The current list of these procedures includes tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy, sputum induction by using nebulised hypertonic saline, dentistry, and autopsy procedures.

Actions

When implementing transmission-based precautions, healthcare workers should:

- Wear surgical masks, eye protection, gowns/aprons, and gloves during patient care
- Ensure appropriate donning and discarding of PPE
- Use single rooms for patients with respiratory diseases
- Do not touch their eyes, noses, or mouths with potentially contaminated gloved or bare hands
- Frequently clean and disinfect surfaces with which patients are in contact
- Perform aerosol-generating procedures in an adequately ventilated room

Strategy 3: Education and training of healthcare workers

Rationale: Healthcare settings are legally obligated to develop, establish, and provide workers with training and educational programmes in health and safety measures and procedures relevant to their responsibilities (Health Protection Surveillance Centre, 2023:23). The provision of adequate training on the recommended inflexional prevention and control measures improves healthcare workers' competency to prevent respiratory infections (Lee et al., 2020:2; Crnich 2022:1912; Ahmad et al., 2022:4).

Actions

Healthcare workers /healthcare managers/stakeholders should:

- Receive adequate education on respiratory infections, focusing on disease characteristics, level of risk in the healthcare service, and the healthcare service plan to respond to the infection
- Be trained on the correct donning and discarding of personal protection equipment
- Have training in standard precautions, hand hygiene, respiratory hygiene, and cough etiquette, along with transmission-based precautions (contact, droplet, and airborne), including the appropriate use of PPE for each situation
- Receive refresher courses on standard and transmission-based precautions if they have been trained
- Be provided with brochures, posters, and banners with information on preventing respiratory infections
- Should include basic IPC in all health pre-curriculum training for medical staff

Strategy 4: Engineering controls

Rationale: Buildings should be designed to be airy and to allow workflow activities to prevent the spread of respiratory diseases and to facilitate the hygiene of healthcare workers, patients, and visitors. The risk of airborne infections spreading from infected patients to susceptible workers, patients, and caregivers should be reduced by proper airflow (Department of Health, Republic of South Africa 2020:34). Isolation of confirmed and suspected cases of respiratory infections can reduce the spread of the thereof (Tarshkandi et al., 2021:1156; Li et al., 2021:5; Hutchinson et al., 2020:121). Social distancing of 1.5 metres for infected and non-infected persons can also prevent the spread of respiratory infections in the healthcare setting (Badr et al., 2021:679-680).

Actions

When ensuring engineering controls, healthcare workers/healthcare managers should:

- Maintain a distance of at least one metre between patients with respiratory infections and other individuals
- Ensure healthcare facilities are designed, furnished, and supplied with materials and finishes that are simple to clean
- Ensure isolation wards equipped with negative-pressure airborne infection-isolation-rooms (AIIRs) are built to accommodate patients with high-risk respiratory infections
- Ensure isolation rooms are in an area separated from other patient care areas
- Ensure that triage and waiting areas are designed and used that transmission of respiratory diseases is prevented
- Ensure that rooms are adequately ventilated when performing aerosol-generating medical procedures
- Maintain ventilation in the healthcare setting, considering comfort and weather. The goal is to achieve reasonable air exchange with gentle air movement. Strong airflow into the room from outside readily felt and causes discomfort is not required and may contribute to airflow from the room
- Ensure rooms are adequate to accommodate wheelchair users and mobile medical equipment and to prevent overcrowding

- Improve indoor ventilation by opening windows or doors
- Reduce the duration of mechanical ventilation for patients on admission and a new ventilator circuit should also be provided to each patient
- Ensure social distancing in an indoor public place

Strategy 5: Active surveillance programme for staff and patients with acute respiratory infections

Rationale: An integral part of any successful IPC policy is surveillance (monitoring for sickness (Health Protection Surveillance Centre, 2023:26). “Public health surveillance is the ongoing systematic collection, analysis, and interpretation of data, closely integrated with the timely dissemination of the resulting information to those responsible for preventing and controlling disease and injury” (Chiolero et al., 2020:1). Surveillance attempts to provide healthcare decision-makers with timely and practical information to help them to set priorities, determine the needed interventions and to evaluate the effect of interventions (Chiolero et al., 2020:1). The effectiveness of newly implemented healthcare interventions can be evaluated, monitored, or checked through surveillance (Gilbert & Cliffe 2016:93).

Actions

- Screening of healthcare workers, patients, and visitors entering the healthcare facility for signs and symptoms of respiratory illnesses
- Healthcare workers should ensure that reporting systems for acute respiratory infections among staff and patients are in place in the healthcare service
- Healthcare workers who develop respiratory infections should report their condition according to facility protocol
- There should be early identification of staff absence/s owing to a respiratory infection outbreak

- Anyone who screens positive on the acute respiratory infections (ARIs) case finding/surveillance protocol should be instructed to implement precautions and later referred for medical assessment
- Patients/visitors and staff in the healthcare setting must be monitored for signs of acute respiratory infection using the recommended device
- There should be effective working relationships between the healthcare setting and the public health unit. Clear lines of communication are maintained. The public health unit is contacted for information and advice as required and the obligation to report any respiratory infection outbreak

Strategy 6: Restriction of visitors and caregivers

Rationale: Limiting the number of family members, visitors, and caregivers in contact with persons with respiratory infections reduce the spread of infections within the healthcare service (WHO 2020g:2). Visitor restrictions are one of the elimination strategies for respiratory infection outbreak (Winkler et al., 2022:311). Rates of healthcare-associated respiratory viral infections among inpatients decrease when visitors are restricted (Wee et al., 2021:124)**.**

Actions

- Healthcare workers should ensure that visitors and family members visiting patients with respiratory infections are limited per facility protocol
- All healthcare settings must have signage at all entrances instructing all clients/patients/residents, visitors, and volunteers about any restrictions implemented
- Visitors must practice hand hygiene, be instructed in, and adhere to appropriate precautions when visiting, and not visit if they have any acute respiratory illness symptoms

- Health care settings where exposure, with or without transmission of respiratory infection, has occurred should restrict the number of entrances into the facility
- Individuals wanting to visit loved ones should use designated entrances in healthcare facilities
- All visitors should continue to wear a well-fitting mask when entering the healthcare facility

Strategy 7: Vaccination of healthcare workers

Rationale: Healthcare workers have often been traced as a source of transmission of vaccine-preventable respiratory diseases to susceptible patients (Maltezou et al., 2022:1). The most reliable method of preventing receptors from infection is vaccination (Wilson et al., 2022:321). "Vaccination of healthcare workers indirectly protects vulnerable patients, especially those who cannot get vaccinated because of host factors (e.g., young infants, pregnant women) or those who do not elicit satisfactory immune responses after vaccination (e.g., elderly, immunocompromised patients)" (Maltezou et al., 2022:1). Vaccination against respiratory infections is important to protect the healthcare worker and the people they care for (Health Protection Surveillance Centre, 2023:12). When healthcare workers are vaccinated, they contribute to the prevention of respiratory disease outbreaks (WHO, 2021:23).

Actions

- Mandatory vaccination for healthcare workers for vaccine-preventable respiratory diseases under national recommendations
- Ensure healthcare workers know that they should be vaccinated, including boosters
- Encourage a high level of vaccine intake by health staff by providing support to staff with questions about the benefits and risks of vaccination
- Provision of education on the benefits and risks of vaccination to healthcare workers

- Ensure healthcare workers have easy access to the vaccination sites
- Ensure promotional activities, such as using promotional material, including advertising posters hung up in the wards, banners in the hospital, an Internet page, and a campaign presentation event to increase vaccination coverage for healthcare staff
- Ensure regular review of the vaccination uptake by healthcare staff regarding respiratory infections

Strategy 8: Promoting healthy behaviours to strengthen the immune system

Rationale: The immune system is vital in the susceptibility and response to infections **(**Vu et al., 2022:2). Our immune system protects us against foreign invaders, including microbial infections. The risk of viral infection is significantly enhanced if the hosts' immunological defence is weak, causing an imbalance between the hosts' pro-inflammatory responses and antiviral activity. Therefore, promoting healthy behaviours to enhance individuals' immunity with nutritious food and supplements may be a rational strategy for minimising damages caused by infections (Han & Hoang 2020:1). To naturally defend the body against respiratory virus infections, the immune system needs support that can be established in healthy behaviour (Jawhara, 2020:1). By strengthening the immune system, the possibility of respiratory infections gets reduced (Iddir et al., 2020:1). Activities that can boost the immune system include exercise, nutrition and hydration, smoking cessation, and stress management (California Department of Public Health, 2023:10; Calcagni et al., 2023:57; Burdsall, 2020:15).

Actions

When ensuring regular exercise:

- Healthcare staff, patients, and the public should be advised to engage in moderate exercises, considering their health condition
- Healthcare workers should educate patients and the public on the risks and benefits of regular moderate-vigorous exercises
- Patients admitted to the ward should be engaged in moderate/passive exercise, depending on their health condition

When ensuring adequate nutrition and hydration:

- Advise patients, healthcare workers, and the public to increase their fluid intake
- Educate the importance of ensuring adequate hydration
- Advise healthcare staff and the public to keep a record of their water intake using the recommended applications (APPs) on their phones
- Encourage healthcare workers, patients, and the public to take a diet rich in vitamins and minerals
- Educate patients and relatives at the healthcare facility
- Provide dietary supplements to the vulnerable (pregnant women, children) in the society

When ensuring smoking cessation:

- Provide health education on the effect of smoking on respiratory infections
- Place banners and posters at the entrance of the healthcare facility showing the effects of smoking
- Provide support for healthcare staff and patients who smoke to quit through counselling programmes

When ensuring stress reduction:

- Educate various stress management techniques to healthcare staff, patients, and the public
- Healthcare managers should implement measures to ensure adequate staff per shift
- Encourage healthcare staff to enjoy their annual holiday according to facility protocol

Strategy 9: Adequate supply of personal protective equipment

Rationale: The WHO advises to use contact and droplet precautions while treating patients who have confirmed or suspected respiratory infection. It is recommended to use airborne safety precautions when performing aerosol-generating activities—all these precautions require using PPE, and the WHO does not recommend the reuse of PPE (WHO, 2020g:1). An adequate supply of PPE to healthcare workers encourages them to use the equipment only once (Health Protection Surveillance 2023:21). Healthcare personnel are more likely to become ill without the supply of proper PPE. Reduction in providing care owing to staff illnesses combined with a high demand for care, leading the healthcare infrastructure to become unstable, resulting in a decline in the quality and quantity of care (Cohen & Rodgers, 2020:2). The health system's capacity is reduced because of ill practitioners' increased demand for care (Cohen & Rodgers, 2020:2). Using recommended equipment by healthcare workers, patients, caregivers, or persons in the healthcare service may prevent the spread of respiratory infections (MOH, 2020:20; Di Cola et al., 2023:3).

Actions

- Provide sufficient and appropriate PPE to healthcare workers, patients, and visitors in the healthcare service.
- The healthcare setting should ensure that the recommended PPE is accessible and available and that staff members have received training in its use

- Ensure patients, caregivers, and visitors in the healthcare facility have access to recommended PPE
- Adequate resources should be devoted to IPC programmes in all healthcare settings, and adequate inventories of PPE should be maintained

Strategy 10: Monitoring and evaluation and investing in research

Rationale: Monitoring and feedback aimed at engaging stakeholders, creating partnerships, and developing working groups and networks. As part of QI, monitoring, audit, and feedback, an important device for informing and convincing health workers and managers of existing problems and solutions has been developed (Department of Health, Republic of South Africa, 2020:186). Correct implementation of IPC measures will minimise the spread of respiratory infection in the healthcare facility (WHO, 2021:16); therefore, IPC divergences should be assessed, and progress in discoursing them. Monitoring staff well-being, establishing mental health support, and giving incentives can prevent negative attitudes towards preventing respiratory infections during an outbreak (Tarshkandi et al., 2021:1158). Research helps to increase knowledge to create efficient vaccines and chemoprophylaxis/treatments for respiratory tract diseases (Crnich, 2022:1912). Regular feedback promotes best practices and, with time, causes behaviour or system change towards improving the quality of care and patient safety (Department of Health, Republic of South Africa, 2020:186).

Actions

Healthcare managers/stakeholders should:

- Conduct adherence monitoring for HCWs on recommended IPC measures using the recommended devices, such as hand hygiene audit

- Ensure regular assessment of the effectiveness of the IPC programme and its impact on practices in the healthcare setting
- Conduct healthcare facility risk assessment and communicate results/feedback to each unit in the healthcare facility
- Be reminded of the need to demonstrate training, and is, therefore, encouraged to document the workers trained, the dates training was conducted, and the information and materials included during training
- Provide support and supervision for staff during an outbreak of a respiratory infection
- Be supported financially when conducting research on respiratory disease and its management in the healthcare setting

4.6 SUMMARY

The scoping review identified 10 strategies to prevent the Healthcare-associated spread of respiratory infections. The strategies identified are specific based on the findings of the healthcare workers' Knowledge, attitudes, and practices towards the novel coronavirus disease. IPC strategies for respiratory infections are similar in the country. The identified strategies can offer a useful contribution to application in various healthcare settings.

Chapter Five evaluates the refinement of strategies to prevent the healthcare-associated spread of respiratory infections.

CHAPTER FIVE

PHASE 2: REFINEMENT OF STRATEGIES TO PREVENT THE HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS

5.1. Introduction

The KAPs of healthcare workers towards preventing respiratory infections in healthcare services were described in Phase 1 of the study. A divergence in the healthcare workers' preventive practices towards COVID-19 and other respiratory infections was identified.

In the first part of this phase, draft strategies were developed to prevent the healthcare-associated spread of respiratory infections. The findings of Phase 1 and an extensive literature review served as basis information for developing the strategy and are incorporated in the draft strategies for refinement (observed in the second part of the phase) through focus group interviews with healthcare managers in the selected five participating healthcare facilities. The concepts of the HBM and the KAP theory were used to structure the strategy. The drafted guidelines meet the criterion of the AGREE instrument. The current part of Phase 2 of the study aimed to refine the formulated strategies to prevent healthcare-associated respiratory infections.

5.2 Process of refinement of the draft strategies to prevent the healthcare-associated spread of respiratory infections

During focus group interviews, the drafted strategies were evaluated, rephrased, removed if it is not applicable and appreciated when they appeared appropriate. The researcher purposively selected and invited 10 healthcare managers of the groups of participants involved in the first phase of the study to participate in refining the draft guidelines. It was assumed that the selected healthcare managers could contribute to refining the strategy to prevent the healthcare-associated spread of respiratory infections.

The researcher believed that the involvement of the healthcare managers from the designated facilities in the Ashanti region may assist with the refinement and approval of realistic strategies that may lead to better collaboration during future implementation.

Table 5.1 presents Focus Group 1 participants' descriptive information. The table summarises the descriptive information about focus group participants who refined the strategy to prevent the healthcare-associated spread of respiratory infections.

Table 5.1: Focus Group 1 participants' descriptive information

Focus Group 1 participants			
No	**Job title**	**Experience in healthcare**	**Position**
1.	Public health nurse	Sixteen years of public health unit manager experience with 24 years of work experience as a professional nurse.	Unit manager
2.	Medical laboratory scientist	Five years of unit manager experience.	Unit manager
3.	Senior professional nurse	Ten years of nursing management experience with 30 years of experience as a professional nurse	Nurse manager
4.	Mental health nurse	Twelve years of work experience as a professional nurse	Unit manager
5.	Paediatric nurse		Unit manager

Focus Group 1 participants			
No	**Job title**	**Experience in healthcare**	**Position**
		Fourteen years of work experience as a professional nurse	

Table 5.2 summarises the descriptive information about Focus Group 2 participants in refining the strategy to prevent the healthcare-associated spread of respiratory infections.

Table 5.2: Descriptive information about Focus Group 2 participants

No	Job title	Experience in healthcare	Position
6.	Medical officer	Seventeen years of medical practitioner experience	Clinical manager
7.	Senior pharmacist	Thirteen years of pharmacy management experience	Pharmacy manager
8.	Medical laboratory scientist	Eighteen years of working experience in healthcare	Public health laboratory manager
9.	Health promotion practitioner	28 years of working experience in healthcare	IPC manager
10.	Senior professional nurse	Five years of nursing unit manager experience with 20 years' experience as a professional nurse	Unit manager

Two focus group interviews were sufficient to acquire significant input from the selected healthcare managers to refine the strategy. The drafted strategies were printed out and provided to participants before the interviews. During the interviews, the formulated strategies were presented as statements to the participants to discuss and debate each strategy and actions, individually. Opinions and comments were encouraged about each strategy and action's applicability and suitability to prevent the healthcare-associated spread of respiratory infections were scrutinised.

The participants were requested to reformulate, add, or remove statements from the drafted set of strategies. The researcher used the comments of Focus Group 1 to refine the strategy developed. The comments during Focus Group 2 were used to refine further the drafted strategies refined during Focus Group 1. The result was a refined set of strategies to prevent the healthcare-associated spread of respiratory infections. In consultation with the research supervisor, it was decided that the strategy was sufficiently refined.

5.3 Outcome of the refining of the actions of the strategy

The participants refined the actions applicable to the strategy. The complete, refined set of strategies and activities is presented in the following chapter. This chapter presents the drafted and refined activities associated with the strategy.

5.3.1 Strategy 1: Healthcare workers must ensure triage, early recognition, and source control with suspected respiratory infections

In the first column of Table 5.3 the draft actions applicable to Strategy 1 are presented. The second column presents changes recommended by participants.

Table 5.3: Strategies for ensuring triage, early recognition, and source control

Actions	Recommended improvements from the healthcare manager participants

Be trained to recognise the signs and symptoms of respiratory infections.	
Display information at the entrance of the healthcare service directing patients with signs and symptoms of ARIs to report for screening.	
Be encouraged to be alert to any respiratory infection outbreak in all patients visiting the service.	Add 'The health promotion officers should inform all staff when there is an outbreak of respiratory infections (FG1)
Pre-triage all patients with cough and fever and provide a surgical mask.	
Wear appropriate PPE and perform regular hand hygiene during the screening of patients.	Change action to 'Wear appropriate personal protective equipment and perform regular hand hygiene before and after the screening of patients.' (FG2)
Use standardised and validated triage devices to identify individuals needing immediate care and those who can safely wait during triaging of other patients.	Add 'for respiratory infections' at the end of devices (FG1)
Encourage all patients with acute respiratory symptoms to wear masks in the waiting area of the healthcare service.	Add another action. Ensure social distancing in the waiting area (FG1)
Ensure early testing for respiratory infections.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.2 Strategy 2: Apply standard and transmission-based precautions

In the first column of Table 5.4, the draft actions applicable to Strategy 2 are presented. The second column presents changes recommended by participants.

Table 5.4: Apply standard and transmission-based precautions

Actions	Recommended improvements from the healthcare manager participants
Standard-based precaution.	
When ensuring hand hygiene, healthcare workers should:	
Wash hands before and after touching a patient, before and after a procedure or body fluid exposure, and after touching a patient's surroundings.	Add 'with soap under running water' at the end of hands (FG1)
Clean hands with alcohol-based sanitiser containing 60-80% alcohol or with soap, water, and disposable towels.	Add as additional actions Hand washing facilities should be maintained in good condition and supplies of paper towels and soap should be topped up regularly to encourage staff/clients to use them (FG2) Posters displaying hand washing techniques and promoting hand washing should be positioned on the wall adjacent to washing facilities; to promote and remind people of the techniques, stages, and processes of hand washing (FG2)
Keep fingernails short and ensure a healthy hand skin.	
When ensuring the appropriate use of PPE, healthcare workers should:	
Perform a risk assessment before encountering patients to determine whether using PPE is required.	

Actions	Recommended improvements from the healthcare manager participants
Be trained on donning and discarding PPE and the scientific basis for the recommendations about protective practices.	
Put on a full set of PPE (N95 Mask, gown, gloves, and eye protection), when managing patients with respiratory infections in high-risk areas.	Add ‘boots and hair cap’ (FG1)
Have prompt access to the recommended PPE.	
Perform a fit test and seal check when using the N95 mask.	
Ensure proper respirator fit by shaving their beard or thick facial hair.	
Remove PPE before leaving the area.	Change action ‘Remove personal protective equipment at a safe area before leaving’ (FG2) Add as additional action, ‘Use disposable personal protective equipment only once and dispose of them appropriately’ (FG2)
Perform hand hygiene immediately after removing PPE.	
When ensuring respiratory hygiene practices:	
Post signs at entrances with instructions to staff, patients, and individuals with symptoms of respiratory infections to:	
Wear masks when necessary.	

Actions	Recommended improvements from the healthcare manager participants
Cough and/or sneeze in a bent elbow or into a disposable tissue and dispose of it immediately in a bin.	
Perform hand hygiene afterwards	
Provide tissue and no-touch bins for disposal of tissues.	
Provide masks to coughing patients and other persons with respiratory infections.	Add as additional action 'Ensure Social distancing' when having respiratory infections (FG1)
When ensuring a clean environment, healthcare workers should:	
Ensure the cleaning of patients' environment, surfaces, medical devices used, and other equipment with water and recommended detergents.	Add 'and disinfectants' at the end of the detergents (FG1) Add as additional actions When leaving the ward, health workers should ensure that their cell phones and spectacles are cleaned. Health workers should aim for more frequent detergent cleaning, followed by disinfection with concentrations of detergents to reduce the chance of being infected and spreading from contaminates (FG2) Ensure high periodic dusting in all healthcare facilities (FG2)

Actions	Recommended improvements from the healthcare manager participants
Ensure that the laundry and the management of linen are completed by safe routine procedures.	
Ensure that medical waste is managed by recommended measures.	Remove ‘by’ and add ‘in accordance with’ (FG2)
Transmission-based precautions.	
When implementing transmission-based precautions, healthcare workers should:	
Wear surgical masks, eye protection, gowns/aprons, and gloves during patient care.	
Ensure appropriate donning and discarding of PPE.	
Use single rooms for patients with respiratory diseases.	Change action ‘Isolation of patients with respiratory disease (FG1) (FG2)
Do not touch their eyes, noses, or mouths with potentially contaminated gloved or bare hands	
Frequently clean and disinfect surfaces with which patients are in contact.	
Perform aerosol-generating procedures in an adequately ventilated room.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.3 Strategy 3: Education and training of healthcare workers

In the first column of Table 5.5, the draft actions applicable to Strategy 3 are presented. The second column presents changes recommended by participants.

Table 5.5: Education and training of healthcare workers

Actions	Recommended improvements from the healthcare manager participants
Healthcare workers/healthcare managers/stakeholders should:	
Receive adequate education on respiratory infections, focusing on disease characteristics, level of risk in the healthcare service, and the healthcare service plan to respond to the infection.	Add 'transmission' at the end of the disease (FG2).
Be trained on the correct donning and discarding of personal protection equipment.	
Have training in standard precautions, hand hygiene, respiratory hygiene, and cough etiquette, along with transmission-based precautions (contact, droplet, and airborne), including the appropriate use of PPE for each situation.	
Receive refresher courses on standard and transmission-based precautions if they have been trained.	Add as an additional action 'Ensure periodic stimulation exercise after receiving training' (FG 2).
Be provided with brochures, posters, and banners with information on preventing respiratory infections.	

Should include basic IPC in all health pre-curriculum training for medical staff.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.4 Strategy 4: Engineering controls

In the first column of Table 5.6, the draft actions applicable to Strategy 4 are presented. The second column presents changes recommended by participants.

Table 5.6: Engineering controls

Actions	Recommended improvements from the healthcare manager participants
When ensuring engineering controls, healthcare workers/healthcare managers should:	
Maintain a distance of at least one metre between patients with respiratory infections and other individuals.	
Ensure healthcare facilities are designed, furnished, and supplied with materials and finishes simple to clean.	Replace ‘simple’ with ‘easy’ (FG2)
Ensure isolation wards equipped with negative-pressure AIIRs are built to accommodate patients with high-risk respiratory infections.	
Ensure isolation rooms are in an area separated from other patient care areas.	
Ensure that triage and waiting areas are designed and used that transmission of respiratory diseases is prevented.	

Actions	Recommended improvements from the healthcare manager participants
Ensure that rooms are adequately ventilated when performing aerosol-generating medical procedures.	
Maintain ventilation in the healthcare setting, considering comfort and weather. The goal is to achieve reasonable air exchange with gentle air movement. Strong airflow in the room from outside is readily felt and causes discomfort is not required and may contribute to airflow from the room.	
Ensure rooms are adequate to accommodate wheelchair users and mobile medical equipment and to prevent overcrowding.	Add ‘spacious’ at the end of ‘are’ (FG1)
Improve indoor ventilation by opening windows or doors.	
Reduce the duration of mechanical ventilation for patients on admission, and a new ventilator circuit should also be provided to each patient.	
Ensure social distancing in an indoor public place.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.5 Strategy 5: Active surveillance programme for staff and patients with acute respiratory infections

In the first column of Table 5.7, the draft actions applicable to Strategy 5 are presented. The second column presents changes recommended by participants.

Table 5.7: Active surveillance programme for staff and patients with acute respiratory infections

Actions	Recommended improvements from the healthcare manager participants
Screening of all healthcare workers and patients and visitors entering the healthcare facility for signs and symptoms of respiratory illnesses.	
Healthcare workers should ensure that reporting systems for ARIs among staff and patients are in place in the healthcare service.	
Healthcare workers who develop respiratory infections should report their condition according to facility protocol.	
There should be early identification of staff absence/s owing to a respiratory infection outbreak.	
Anyone who screens positive on the ARIs case finding/surveillance protocol should be instructed to implement precautions and later referred for medical assessment.	
Patients/visitors and staff in the healthcare setting must be monitored for signs of acute respiratory infection using the recommended device.	
There should be effective working relationships between the healthcare setting and the public health unit. Clear lines of communication are maintained. The public	Replace ‘Healthcare setting’ with ‘curative unit’ (FG1)

Actions	Recommended improvements from the healthcare manager participants
health unit is contacted for information and advice as required and the obligations to report any respiratory infection outbreak.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.6 Strategy 6: Restriction of visitors and caregivers

In the first column of Table 5.8, the draft actions applicable to Strategy 6 are presented. The second column presents changes recommended by participants.

Table 5.8: Restriction of visitors and caregivers

Actions	Recommended improvements from the healthcare manager participants
Healthcare workers should ensure that visitors and family members visiting patients with respiratory infections are limited per facility protocol.	
All healthcare settings must have signage posted at all entrances instructing all clients/patients/residents, visitors, and volunteers about any restrictions implemented.	
Visitors must practice hand hygiene, be instructed in, and adhere to appropriate precautions when visiting, and not visit if they have any acute respiratory illness/ symptoms.	
Health care settings where exposure, with or without transmission of respiratory infection,	

Actions	Recommended improvements from the healthcare manager participants
has occurred should restrict the number of entrances into the facility.	
Individuals wanting to visit loved ones should use designated entrances in healthcare facilities.	
All visitors should continue to wear a well-fitting mask when entering the healthcare facility.	Add ‘and relatives’ at the end of visitors (FG2)
Healthcare workers should ensure that visitors and family members visiting patients with respiratory infections are limited per facility protocol.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.7 Strategy 7: Vaccination of healthcare workers

In the first column of Table 5.9, the draft actions applicable to Strategy 7 are presented. The second column presents changes recommended by participants.

Table 5.9: Vaccination of healthcare workers as recommended by WHO/MOH

Actions	Recommended improvements from the healthcare manager participants
Mandatory vaccination for healthcare workers for vaccine-preventable respiratory diseases under national recommendations.	
Ensure healthcare workers know that they should be vaccinated, including boosters.	

Actions	Recommended improvements from the healthcare manager participants
Encourage a high level of vaccine intake by health staff by providing support to staff with questions about the benefits and risks of vaccination.	
Provision of education on the benefits and risks of vaccination to healthcare workers.	
Ensure healthcare workers have easy access to the vaccination sites.	Replace 'sites with 'centres' (FG1)
Ensure promotional activities, such as using promotional material, including advertising posters, hung up in the wards, banners in the hospital, an Internet page, and a campaign presentation event to increase vaccination coverage for healthcare staff.	Add as additional action 'Ensure health care staff who take vaccinations are motivated' **(**FG2)
Ensure regular review of the vaccination uptake by healthcare staff regarding respiratory infections.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.8 Strategy 8: Promoting healthy behaviours to strengthen the immune system

In the first column of Table 5.10, the draft actions applicable to Strategy 8 are presented. The second column presents changes recommended by participants.

Table 5.10: Promoting healthy behaviours to strengthen the immune system

Actions	Recommended improvements from the healthcare manager participants
When ensuring regular exercise:	

Actions	Recommended improvements from the healthcare manager participants
Healthcare staff, patients, and the public should be advised to engage in moderate exercises, considering their health condition.	
Healthcare workers should educate patients and the public on the risks and benefits of regular moderate-vigorous exercises.	
Patients admitted to the ward should be engaged in moderate/passive exercise, depending on their health condition.	
When ensuring adequate nutrition and hydration:	
Advise patients, healthcare workers, and the public to increase fluid intake.	P2 Replace ‘Advise’ with ‘Encourage’ (FG1)
Educate the importance of ensuring adequate hydration.	
Advise healthcare staff and the public to record their water intake using the recommended applications on their phones.	P2 Replace ‘Advise’ with ‘Encourage’ (FG1)
Encourage healthcare workers, patients, and the public to take a diet rich in vitamins and minerals.	
Educate patients and relatives at the healthcare facility.	
Provide dietary supplements to the vulnerable (pregnant women, children) in the society.	Add ‘the Aged’ (FG1) Add ‘as well as Healthcare workers’ at the end of the society (FG2)
When ensuring smoking cessation:	

Actions	Recommended improvements from the healthcare manager participants
Provide health education on the effects of smoking on respiratory infections.	
Place banners and posters at the entrance of the healthcare facility showing the effects of smoking.	
Provide support for healthcare staff and patients who smoke to quit through counselling programmes.	
When ensuring stress reduction:	
Educate various stress management techniques to healthcare staff, patients, and the public.	
Healthcare managers should implement measures to ensure adequate staff per shift.	
Encourage healthcare staff to enjoy their annual holiday according to facility protocol.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.9 Strategy 9: Adequate supply of personal protective equipment

In the first column of

Table 5.11, the draft actions applicable to Strategy 9 are presented. The second column presents changes recommended by participants.

Table 5.11: Adequate supply of personal protective equipment

Actions	Recommended improvements from the healthcare manager participants
Provide sufficient and appropriate PPE to healthcare workers, patients, and visitors in the healthcare service.	Add 'The healthcare setting should' at the beginning of the sentence **(**FG1)
The healthcare setting should ensure that the recommended PPE is accessible and available and that staff members have received training on its use.	Rephrase it 'The healthcare setting should ensure that the recommended PPE are available and accessible and that staff members have received training on its usage and disposal (FG2)
Ensure patients, caregivers, and visitors in the healthcare facility have access to recommended PPE.	Add 'regular' in front of the 'access' (FG2)
Adequate resources should be devoted to IPC programmes in all healthcare settings, and adequate inventories of PPE should be maintained.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

5.3.10 Strategy 10: Monitoring and evaluation and investing in research

In the first column of

Table 5.12, the draft actions applicable to Strategy 10 are presented. The second column presents changes recommended by participants.

Table 5.12: Monitoring and evaluation and investing in research

Actions	Recommended improvements from the healthcare manager participants
Healthcare managers/stakeholders should:	
Conduct adherence monitoring for healthcare workers on recommended IPC measures, using the recommended devices, such as Hand Hygiene audit.	
Ensure regular assessment of the effectiveness of the IPC programme and its impact on practices in the healthcare setting.	
Conduct healthcare facility risk assessment and communicate results/feedback to each unit in the healthcare facility.	
Be reminded of the need to demonstrate training, and is, therefore, encouraged to document the workers trained, the dates training was conducted, and the information and materials included during training.	Change action 'be reminded of the need to be able to demonstrate training, and the importance to document the workers who are trained, the dates training was conducted, and the information and materials covered during training' **(**FG1)
Provide support and supervision for staff during an outbreak of a respiratory infection.	
Be supported financially when researching respiratory disease and its management in the healthcare setting.	

FG1: changes recommended during Focus Group Interview 1.
FG2: changes recommended during Focus Group Interview 2.

The researcher incorporated the recommended changes from the focus group participants as they added value to the refinement of the strategy. The changes included replacing words with others or rephrasing an action totality to enhance clarity. Several actions helped enhance the completeness of the strategy.

5.4 Summary

The steps followed to develop and refine strategies to prevent the healthcare-associated spread of respiratory infections are discussed. Using focus group interviews to refine the strategy with inputs from focus group participants is discussed. Chapter Six is the concluding chapter, refining a set of strategy, the study's conclusion, implications, and presenting recommendations.

CHAPTER SIX

THE STRATEGIES, RECOMMENDATIONS, SUMMARY, AND CONCLUSIONS

6.1. Introduction

The research to determine healthcare workers' knowledge, attitudes, and practices towards COVID-19 and to develop and refine strategies to prevent the healthcare-associated spread of respiratory infections was conducted in two phases, presented in previous chapters.

- Chapter One introduces the study and provides background information, indicating the need to assess healthcare workers' KAPs during the COVID-19 pandemic and to develop strategies to prevent the healthcare-associated spread of respiratory infections.
- Chapter Two describes the methodology of the research.
- Chapter Three presents the findings of Phase 1 of the study—the cross-sectional survey of healthcare workers' KAPs towards COVID-19 are presented.
- Chapter Four discusses the findings of Phase 1 and a relevant literature review to develop strategies for Phase 2.
- Chapter Five discourses the process of refinement of the strategy.
- Chapter Six presents the strategy, recommendations, summary, and conclusion of the study.

6.2 Summary of the study

The study aimed to determine the healthcare workers' knowledge, attitudes, and practices towards COVID-19 and to develop and refine strategies to prevent the healthcare-associated spread of respiratory infections. A cross-sectional study on 373 healthcare workers' KAPs towards the COVID-19 respiratory pandemic was conducted.

The researcher established that 85.8% of the healthcare worker participants had good knowledge of COVID-19. Age and religious affiliation were significantly associated with factors affecting the knowledge level about the novel coronavirus disease; 56.6% of the participants had a good attitude towards COVID-19. The duration of the experience and marital status of the participants were strongly associated with their good attitudes. Less than 50% of the participants had good or excellent preventive practices towards COVID-19. Gender, level of education, and source of information were associated with the participants' practices towards preventing the spread of COVID-19.

Findings from Phase 1 of the study and the outcome of an extensive literature review were used to draft strategies to prevent the healthcare-associated spread of respiratory infections. The concepts of the HBM and the KAP theory were used to structure the strategy. After that, the strategy was refined from the inputs obtained from manager participants of designated healthcare facilities in Ghana during two focus group interviews. Ten (10) healthcare managers from the designated hospitals in the Ashanti region participated. The drafted strategies were reviewed and updated after each focus group interview in a continual process. The two focus group interviews were sufficient for gaining good input to compile a final set of strategies for potential use by all healthcare facilities in the GHS.

The strategies refer to:

- Ensuring triage, early recognition, and source control for suspected respiratory infections
- Apply standard and transmission-based precaution
- Education and training of healthcare workers
- Engineering controls
- Active surveillance programme for staff, visitors, and patients with ARIs
- Restriction of visitors and caregivers

- Vaccination of HCWs as recommended by the WHO/MOH
- Promoting healthy behaviours to strengthen the immune system
- Adequate supply of PPE
- Monitoring and evaluation and investing in research

6.3 Description of the strategy

The strategies to prevent the healthcare-associated spread of respiratory infections are described within the contextual framework of designated healthcare facilities and the comprehensive literature review. Each strategy includes a rationale explaining the reasons for actions to prevent the healthcare-associated spread of respiratory infections. The inputs of the healthcare managers from the five selected healthcare facilities guarantee the delineation of practical and realistic strategies and actions for future use. The next section presents a description of the strategy to prevent the healthcare-associated spread of respiratory infections.

6.4 STRATEGIES TO PREVENT THE HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS

PREAMBLE

Healthcare-associated infections constitute a major public health concern. Health systems’ costs rise because of prolonged hospitalisation caused by infections, which often and significantly impair patients’ life quality. Respiratory infections significantly increase the number of patients in healthcare services. Healthcare-associated respiratory infections absent at the time of admission of patients often aggravates already overburdened hospitals and clinics. There are numerous ways respiratory diseases spread in healthcare services, including airborne, droplet, and direct contact. The transmission routes depend on the pathogen and environmental factors.

To discourse this public health concern, the researcher conducted a cross-sectional study on 373 healthcare workers in Ghana to assess their KAPs towards preventing respiratory infections in healthcare services. A divergence in the healthcare workers' preventive practices towards COVID-19 and other respiratory infections was identified, suggesting that interventions should go far beyond just knowledge and attitude; however, strategies should be developed to prevent the healthcare-associated spread of COVID-19 and other respiratory infections.

The study findings were used as search terms in an extensive literature review, employing the Joanna Briggs Institute methodological framework for scoping reviews. The review's outcome, combined with the findings of the cross-sectional study, were used to draft strategies to prevent the healthcare-associated spread of respiratory infections. Focus group interviews with managers from designated healthcare services were used to refine the strategy and to ensure that they are easily implementable. The concepts of the HBM and the KAP structure the strategy. The guidelines meet the criterion of the AGREE instrument.

Scope and purpose of the strategy: The strategies focus on practices that healthcare workers can adopt to prevent the healthcare-associated spread of respiratory infections.

Stakeholder involvement in developing the strategy: Nurses and all other members of the healthcare team are the target users of the strategy. They were represented in the first phase of the study to obtain baseline information for developing the guidelines and were involved in refining the strategy.

Rigour of development of the guidelines: Systematic methods were used to search for evidence. A scoping review using the Joanna Briggs Institute methodological framework for scoping reviews was used to explore and analyse the literature. The search words for the literature search were identified in the findings of the cross-sectional study on 373 healthcare workers in Ghana to assess their KAPs towards preventing respiratory infections in healthcare services. A thematic analysis of the outcome of the literature review was conducted and 10 themes emerged. Each theme represents a strategy.

The clarity of presentation and applicability of the guidelines were explored and described during the refinement of the strategy. Each strategy has a rationale and actions to be taken by the target user.

Application of the HBM and the KAP theory in the strategy

Healthcare workers’ KAPs should be discoursed in the prevention of the spread of healthcare-associated respiratory infections. Knowledgeable healthcare workers may not have a positive attitude towards preventing the spread of healthcare-associated respiratory infections and may, therefore, not practice preventive measures. The strategies, therefore, address not only the knowledge of the workers to prevent the spread of infections, but also their attitude towards and their practice of preventive measures.

The core of the HBM rests on the opinions of people they are susceptible to illnesses and that they can change their behaviour to prevent illnesses. The opinions are influenced by socio-demographic and psychosocial components. In developing strategies to induce a desirable health behaviour, healthcare workers' opinions about preventing respiratory infections apply.

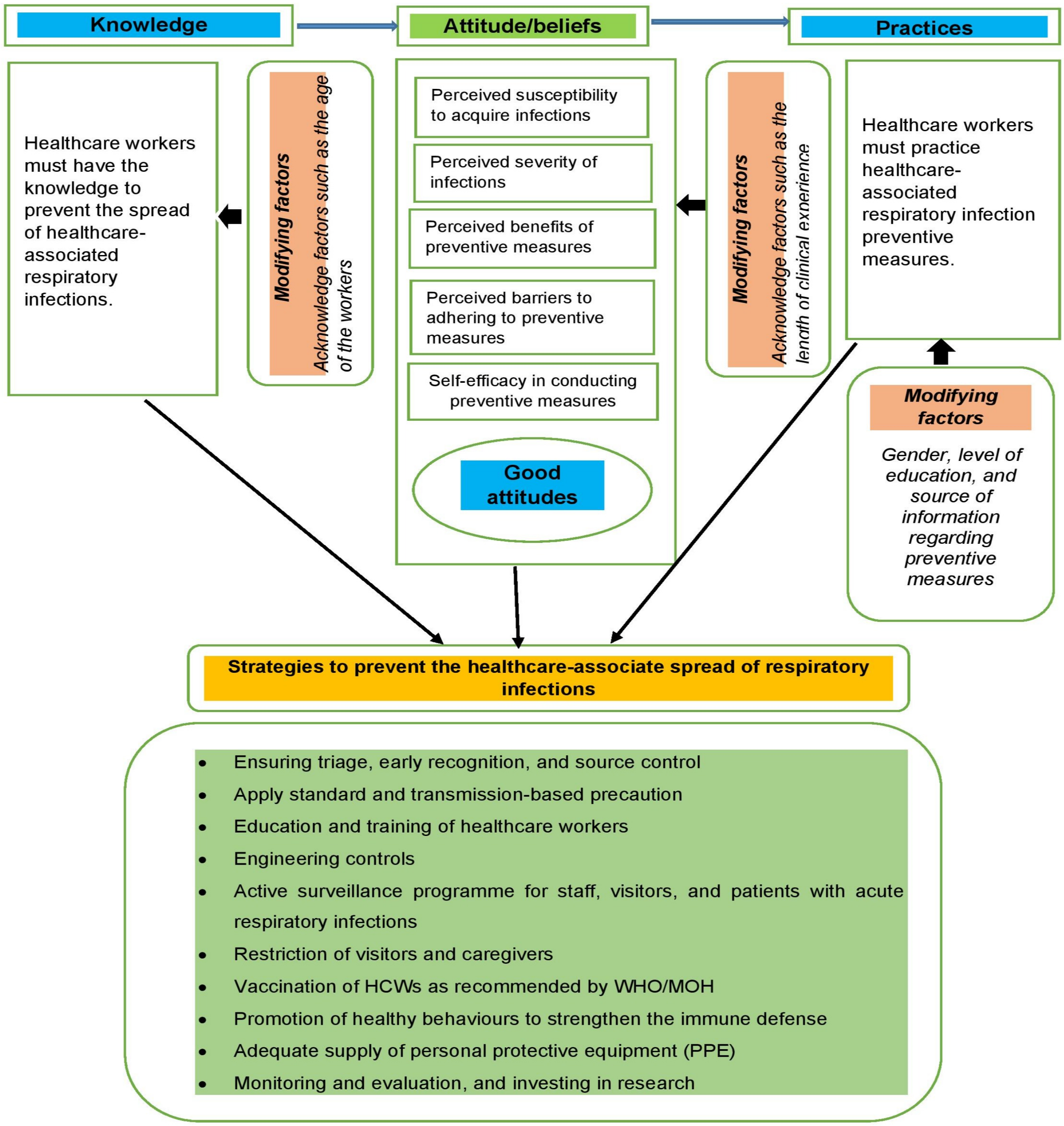


Figure: **Framework for the strategy to prevent the healthcare-associated spread of respiratory infections based on the health belief model and the knowledge, attitude, and practice theory**

Strategy 1: Healthcare workers must ensure triage, early recognition, and source control with suspected respiratory infections

Rationale: Respiratory symptoms are the most common complaint in healthcare services. These symptoms can resolve without treatment, but they can also indicate a severe illness (Ellertsson et al., 2023:1). Respiratory infections can spread within the healthcare service if not promptly detected. Early screening and triaging of patients with acute respiratory symptoms should be of medical priority (WHO 2021:5). Triaging patients before in-person consultation and admission of a patient would help to reduce the spread of respiratory infections among healthcare workers, visitors, and other patients in the healthcare service (WHO 2021:5). Appropriate triaging and bed allocation may reduce the rate of infections (Thibon et al., 2021:6).

Actions

When ensuring triage, early recognition, and source control, healthcare workers/health promotion officers should:

- Be trained to recognise the signs and symptoms of respiratory infections
- Display information at the entrance of the healthcare service directing patients with signs and symptoms of ARIs to report for screening
- Be encouraged to be alert to any respiratory infection outbreak in all patients visiting the service
- Should inform all staff when there is an outbreak of respiratory infections
- Pre-triage all patients with cough and fever, and provide a surgical mask
- Wear appropriate PPE and perform regular hand hygiene before and after the screening of patients

- Use standardised and validated triage devices for respiratory infections to identify individuals needing immediate care and those who can safely wait, during triaging of other patients
- Encourage all patients with acute respiratory symptoms to wear masks in the waiting area of the healthcare service
- Ensure early testing for respiratory infections
- Ensure social distancing in the waiting area

Strategy 2: Apply standard and transmission-based precautions

Standard precautions

Rationale: Standard precautions aim to reduce the risk of transmission of blood-borne and other pathogens from recognised and unrecognised sources and are the basic level of interpersonal care precautions that should always be used in the care of all patients. Standard precautions refer to good hand hygiene practices, appropriate use of personal protection equipment, good respiratory hygiene, optimal cough etiquette, exquisite environmental cleaning and disinfection, safe handling of linen and laundry, and careful waste management (WHO 2021:5).

Properly using recommended PPE by healthcare workers, patients, caregivers, or persons in the healthcare setting, prevents the spread of respiratory infections (Bludau et al., 2022:33; Alqahtani et al., 2022:10).

Actions

When ensuring hand hygiene, healthcare workers should:

- Wash hands with soap under running water before and after touching a patient, before and after a procedure or body fluid exposure, and after touching a patient's surroundings
- Clean hands with alcohol-based sanitiser containing 60-80% alcohol or with soap, water, and disposable towels
- Keep fingernails short and ensure a healthy hand skin
- Should maintain hand washing facilities in good condition and supplies of paper towels and soap should be topped up regularly to encourage staff/clients to use them
- Should place posters on the wall adjacent to washing facilities; displaying hand washing techniques and promoting hand washing; to promote and remind people of the techniques, stages, and processes of hand washing

When ensuring the appropriate use of PPE, healthcare workers should:

- Perform a risk assessment before encountering patients to determine whether using PPE is required
- Be trained on donning and discarding PPE and the scientific basis for the recommendations about protective practices
- Put on a full set of PPE (N95 Mask, gown, gloves, boots, hair cap and eye protection), when managing patients with respiratory infections in high-risk areas
- Have prompt access to the recommended PPE
- Perform a fit test and seal check when using the N95 mask
- Ensure proper respirator fit by shaving their beard or thick facial hair
- Remove PPE at a safe area before leaving
- Use disposable PPE only once and dispose appropriately
- Perform hand hygiene immediately after removing PPE

When ensuring respiratory hygiene practices:

- Post signs at entrances with instructions to staff, patients, and individuals with symptoms of respiratory infections to:

  iv. Wear masks when necessary
  v. Cough and/or sneeze in a bent elbow or into a disposable tissue and dispose of it immediately in a bin
  vi. Perform hand hygiene afterwards

- Provide tissue and no-touch bins for disposal of tissues
- Provide masks to coughing patients and other persons with respiratory infections
- Ensure Social distancing when having respiratory infections

When ensuring a clean environment, healthcare workers should:

- Ensure the cleaning of patients' environment, surfaces, medical devices used, and other equipment with water and recommended detergents/disinfectants
- Ensure that the laundry and the management of linen are completed by safe routine procedures
- Ensure that medical waste is managed under recommended measures
- Should ensure that their cell phones and spectacles are cleaned, when leaving the ward
- Health workers should aim for more frequent detergent cleaning, followed by disinfection with concentrations of detergents to reduce the chance of being infected and spreading from contaminates
- Ensure periodic dusting in all healthcare facilities

Transmission-based precautions

In addition to standard precautions, all individuals should use contact and droplet precautions before entering a room where there are patients with suspected or confirmed respiratory diseases. Aerosol-generating procedures have been associated with an increased risk of transmission of respiratory viruses; therefore, the WHO recommends special airborne precautions when performing these procedures (WHO 2021:9). The current list of these procedures includes tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy, sputum induction by using nebulised hypertonic saline, dentistry, and autopsy procedures.

Actions

When implementing transmission-based precautions, healthcare workers should:

- Wear surgical masks, eye protection, gowns/aprons, and gloves during patient care
- Ensure appropriate donning and discarding of PPE
- Isolation of patients with respiratory disease
- Do not touch their eyes, noses, or mouths with potentially contaminated gloved or bare hands
- Frequently clean and disinfect surfaces with which patients are in contact
- Perform aerosol-generating procedures in an adequately ventilated room

Strategy 3: Education and training of healthcare workers

Rationale: Healthcare settings are legally obligated to develop, establish, and provide workers with training and educational programmes in health and safety measures and procedures relevant to their responsibilities (Health Protection Surveillance Centre, 2023:23). The provision of adequate training on the recommended inflexional prevention and control measures improves healthcare workers' competency to prevent respiratory infections (Lee et al., 2020:2; Crnich 2022:1912; Ahmad et al., 2022:4).

Actions

Healthcare workers/healthcare managers/stakeholders should:

- Receive adequate education on respiratory infections, focusing on characteristics of the disease transmission, level of risk in the healthcare service, and the healthcare service plan to respond to the infection
- Be trained on the correct donning and discarding of personal protection equipment
- Have training in standard precautions, hand hygiene, respiratory hygiene, and cough etiquette, along with transmission-based precautions (contact, droplet, and airborne), including the appropriate use of PPE for each situation
- Receive refresher courses on standard and transmission-based precautions if they have been trained
- Ensure periodic stimulation exercise after receiving training
- Be provided with brochures, posters, and banners with information on preventing respiratory infections
- Should include basic IPC in all health pre-curriculum training for medical staff

Strategy 4: Engineering controls

Rationale: Buildings should be designed to be airy and to allow workflow activities to prevent the spread of respiratory diseases and to facilitate the hygiene of healthcare workers, patients, and visitors. The risk of airborne infections spreading from infected patients to susceptible workers, patients, and caregivers should be reduced by proper airflow (Department of Health, Republic of South Africa 2020:34). Isolation of confirmed and suspected cases of respiratory infections can reduce the spread of the thereof (Tarshkandi et al., 2021:1156; Li et al., 2021:5; Hutchinson et al., 2020:121). Social distancing of 1.5 metres for infected and non-infected persons can also prevent the spread of respiratory infections in the healthcare setting (Badr et al., 2021:679-680).

Actions

When ensuring engineering controls, healthcare workers/healthcare managers should:

- Maintain a distance of at least one metre between patients with respiratory infections and other individuals
- Ensure healthcare facilities are designed, furnished, and supplied with materials and finishes easy to clean
- Ensure isolation wards equipped with negative-pressure AIIRs are built to accommodate patients with high-risk respiratory infections
- Ensure isolation rooms are in an area separated from other patient care areas
- Ensure that triage and waiting areas are designed and used in a way that transmission of respiratory diseases is prevented
- Ensure that rooms are adequately ventilated when performing aerosol-generating medical procedures
- Maintain ventilation in the healthcare setting, considering comfort and weather. The goal is to achieve reasonable air exchange with gentle air movement. Strong airflow in the room from outside readily felt and causes discomfort is not required and may contribute to airflow from the room
- Ensure rooms are spacious adequate to accommodate wheelchair users and mobile medical equipment and to prevent overcrowding
- Improve indoor ventilation by opening windows or doors

- Reduce the duration of mechanical ventilation for patients on admission and a new ventilator circuit should also be provided to each patient
- Ensure social distancing in an indoor public place

Strategy 5: Active surveillance programme for staff and patients with acute respiratory infections

Rationale: An integral part of any successful IPC policy is surveillance (monitoring for sickness) (Health Protection Surveillance Centre, 2023:26). “Public health surveillance is the ongoing systematic collection, analysis, and interpretation of data, closely integrated with the timely dissemination of the resulting information to those responsible for preventing and controlling disease and injury” (Chiolero et al., 2020:1). Surveillance attempts to provide healthcare decision-makers with timely and practical information to help them to set priorities, determine the needed interventions and to evaluate the effect of interventions (Chiolero et al., 2020:1). The effectiveness of newly implemented healthcare interventions can be evaluated, monitored, or checked through surveillance (Gilbert & Cliffe 2016:93).

Actions

- Screening of healthcare workers, patients, and visitors entering the healthcare facility for signs and symptoms of respiratory illnesses.
- Healthcare workers should ensure that reporting systems for ARIs among staff and patients are in place in the healthcare service.
- Healthcare workers who develop respiratory infections should report their condition according to facility protocol.

- There should be early identification of staff absence/s owing to a respiratory infection outbreak.
- Anyone who screens positive on the ARIs case finding/surveillance protocol should be instructed to implement precautions and later referred for medical assessment.
- Patients/visitors and staff in the healthcare setting must be monitored for signs of acute respiratory infection using the recommended device.
- There should be effective working relationships between the curative unit and the public health unit. Clear lines of communication are maintained. The public health unit is contacted for information and advice as required and the obligations to report any respiratory infection outbreak.

Strategy 6: Restriction of visitors and caregivers

Rationale: Limiting the number of family members, visitors, and caregivers in contact with persons with respiratory infections reduces the spread of infections within the healthcare service (WHO 2020g:2). Visitor restrictions are one of the elimination strategies for respiratory infection outbreak (Winkler et al., 2022:311). Rates of healthcare-associated respiratory viral infections among inpatients decrease when visitors are restricted (Wee et al., 2021:124).

Action

- Healthcare workers should ensure that visitors and family members visiting patients with respiratory infections are limited per facility protocol.
- All healthcare settings must have signage posted at all entrances instructing all clients/patients/residents, visitors, and volunteers about any restrictions implemented.

- Visitors must practice hand hygiene, be instructed in, and adhere to appropriate precautions when visiting, and not visit if they have any acute respiratory illness symptoms.
- Health care settings where exposure, with or without transmission of respiratory infection, has occurred should restrict the number of entrances into the facility.
- Individuals wanting to visit loved ones should use designated entrances in healthcare facilities.
- All visitors and relatives should continue to wear a well-fitting mask when entering the healthcare facility.

Strategy 7: Vaccination of Healthcare workers as recommended by WHO/MOH

Rationale: Healthcare workers have often been traced as a source of transmission of vaccine-preventable respiratory diseases to susceptible patients (Maltezou et al., 2022:1). The most reliable method of preventing receptors from infection is vaccination (Wilson et al., 2022:321). “Vaccination of healthcare workers indirectly protects vulnerable patients especially those who cannot get vaccinated because of host factors (e.g., young infants, pregnant women) or those who do not elicit satisfactory immune responses after vaccination (e.g., elderly, immunocompromised patients)” (Maltezou et al., 2022:1). Vaccination against respiratory infections is important to protect the healthcare worker and the people they care for (Health Protection Surveillance Centre, 2023:12). When healthcare workers are vaccinated, they contribute to the prevention of respiratory disease outbreaks (WHO, 2021:23).

Action

- Mandatory vaccination for healthcare workers for vaccine-preventable respiratory diseases under national recommendations
- Ensure healthcare workers know that they should be vaccinated, including boosters
- Encourage a high level of vaccine intake by health staff by providing support to staff with questions about the benefits and risks of vaccination
- Provision of education on the benefits and risks of vaccination to healthcare workers
- Ensure healthcare workers have easy access to the vaccination centres
- Ensure promotional activities, such as using promotional material, including advertising posters hung up in the wards, banners in the hospital, an Internet page, and a campaign presentation event to increase vaccination coverage for healthcare staff
- Ensure regular review of the uptake of vaccination by healthcare staff regarding respiratory infections
- Ensure healthcare staff who take vaccinations are motivated

Strategy 8: Promoting healthy behaviours to strengthen the immune system

Rationale: The immune system is vital in the susceptibility and response to infections **(**Vu et al., 2022:2). Our immune system protects us against foreign invaders, including various microbial infections. The risk of viral infection is significantly enhanced if the hosts' immunological defence is weak, causing an imbalance between the hosts' pro-inflammatory responses and antiviral activity; therefore, promoting healthy behaviours to enhance individuals' immunity with nutritious food and supplements may be a rational strategy for minimising damages caused by infections (Han & Hoang 2020:1).

To naturally defend the body against respiratory virus infections, the immune system needs support that can be established in healthy behaviour (Jawhara, 2020:1). By strengthening the immune system, the possibility of respiratory infections gets reduced (Iddir et al., 2020:1). Activities that can boost the immune system include exercise, nutrition and hydration, smoking cessation, and stress management (California Department of Public Health, 2021:10; Calcagni et al., 2023:57; Burdsall, 2020:15).

Actions

When ensuring regular exercise:

- Healthcare staff, patients, and the public should be advised to engage in moderate exercises, considering their health condition
- Healthcare workers should educate patients and the public on the risks and benefits of regular moderate-vigorous exercises
- Patients admitted to the ward should be engaged in moderate/passive exercise, depending on their health condition

When ensuring adequate nutrition and hydration:

- Healthcare workers, patients and the public should be encouraged to increase their fluid intake
- Educate the importance of ensuring adequate hydration
- Encourage healthcare staff and the public to keep a record of their water intake using the recommended applications (APPs) on their phones
- Encourage healthcare workers, patients, and the public to take a diet rich in vitamins and minerals
- Educate patients and relatives at the healthcare facility

- Provide dietary supplements to the vulnerable (pregnant women, children, aged) in the society and healthcare workers

When ensuring smoking cessation:

- Provide health education on the effect of smoking on respiratory infections
- Place banners and posters at the entrance of the healthcare facility showing the effects of smoking
- Provide support for healthcare staff and patients who smoke to quit through counselling programmes

When ensuring stress reduction:

- Educate various stress management techniques to healthcare staff, patients, and the public
- Healthcare managers should implement measures to ensure adequate staff per shift
- Encourage healthcare staff to enjoy their annual vacation according to facility protocol

Strategy 9: Adequate supply of personal protective equipment

Rationale: The WHO advises using contact and droplet precautions while treating patients who have confirmed or suspected respiratory infection. It is recommended to use airborne safety precautions when performing aerosol-generating activities. All these precautions required using PPE, and the WHO does not recommend reuse of PPE (WHO, 2020g:1). An adequate supply of PPE to healthcare workers encourages them to use the equipment only once (Health Protection Surveillance 2023:21). Healthcare personnel are more likely to become ill without the supply of proper PPE.

Reduction in providing care owing to staff illnesses combined with high demand for care, leading the healthcare infrastructure to become unstable, resulting in a decline in the quality and quantity of care (Cohen & Rodgers, 2020:2). The health system's capacity is reduced because of ill practitioners' increased demand for care (Cohen & Rodgers, 2020:2). Using recommended equipment by healthcare workers, patients, caregivers, or persons in the healthcare service may prevent the spread of respiratory infections (MOH Ghana 2020:20; Di Cola et al., 2023:3).

Actions

- The healthcare setting should provide sufficient and appropriate PPE to healthcare workers, patients, and visitors in the healthcare service.
- The healthcare setting should ensure that the recommended PPE are available and accessible, and that staff members have received training on its usage and disposal.
- Ensure patients, caregivers, and visitors in the healthcare facility have regular access to recommended PPE.
- Adequate resources should be devoted to IPC programmes in all healthcare settings, and adequate inventories of PPE should be maintained.

Strategy 10: Monitoring and Evaluation and investing in research

Rationale: Monitoring and feedback aimed at engaging stakeholders, creating partnerships, and developing working groups and networks. As part of QI, monitoring, audit, and feedback, an important device for informing and convincing health workers and managers of existing problems and solutions has been developed (Department of Health, Republic of South Africa, 2020: 186). Correct implementation of IPC measures will minimise the spread of respiratory infection in the healthcare facility (WHO, 2021:16);

therefore, IPC divergences should be assessed, and progress in discoursing them. Monitoring staff well-being, establishing mental health support, and giving incentives can prevent negative attitudes towards preventing respiratory infections during an outbreak (Tarshkandi et al., 2021:1158). Research helps to increase knowledge to create efficient vaccines and chemoprophylaxis/treatments for respiratory tract diseases (Crnich, 2022:1912). Regular feedback promotes best practices and, with time, causes behaviour or system change towards improving the quality of care and patient safety (Department of Health, Republic of South Africa, 2020:186).

Actions

Healthcare managers/stakeholders should:

- Conduct adherence monitoring for HCWs on recommended IPC measures, using the recommended devices, such as hand hygiene audit
- Ensure regular assessment of the effectiveness of the IPC programme and its impact on practices in the healthcare setting
- Conduct healthcare facility risk assessment, and communicate results/feedback to each unit in the healthcare facility
- Be reminded of the need to demonstrate training, and the importance to document trained workers, the dates training was conducted, and the information and materials included during training
- Provide support and supervision for staff during an outbreak of a respiratory infection
- Be supported financially when conducting research on respiratory disease and its management in the healthcare setting

6.5 Recommendations for practice and research

The recommendations made from the study are based on the strategy that have been developed. It emphasises the prevention of the spread of respiratory infection in the healthcare setting. The strategies should be used in the effort to prevent the healthcare-associated spread of respiratory infections. The strategies can be a complete set or can be introduced gradually through presentation during staff meetings and annual performance reviews.

Implementation research is recommended to evaluate using the strategy to prevent the healthcare-associated spread of respiratory infections. Studies to determine the impact of the strategy are recommended.

Further studies and replication of the current study should be considered in other healthcare facilities. Similar studies should be considered in private and public healthcare facilities, considering the differences in the working environment.

6.6 Limitations of the study

Despite the significance of the study, one limitation of this study could be solicited in future research. The healthcare workers were assessed on their KAPs on one respiratory infection (COVID-19) and not the others; therefore, the researcher considered this limitation during the conclusion of the study.

6.7 Conclusion

The study was to determine healthcare workers' knowledge, attitudes, and practices towards COVID-19 and to develop and refine strategies to prevent the healthcare-associated spread of respiratory infections. The study findings confirm that healthcare workers had good knowledge and attitude towards COVID-19 but had poor preventive practices suggesting that strategies should be developed to prevent the healthcare-associated spread of respiratory infections. Strategies that can help prevent the healthcare-associated spread of respiratory infections have been developed, refined, and presented.

REFERENCES

Abene, E.E., Ocheke, A.N., Ozoilo, K.N., Gimba, Z.M., Okeke, E.N., Agbaji, O.O., & Agaba, E.I. (2021). Knowledge, attitudes and practices towards Covid-19 among Nigerian healthcare workers during the Covid-19 pandemic: A single centre survey. *Nigerian journal of clinical practice*, *24* (12), 1846–1851. https://doi.org/10.4103/njcp.njcp_365_20

Affedzie, O.E. (2017). The Health Belief Model: A conceptual framework for preventing HIV and AIDS through the ABC model. 14 July 2017. Ghana Web. [online]. (Accessed 17 August 2020).

Ahmad, J., Anwar, S., Latif, A., Haq, N.U., Sharif, M., & Nauman, A.A. (2022). Association of PPE Availability, Training, and Practices with COVID-19 Sero-Prevalence in Nurses and Paramedics in Tertiary Care Hospitals of Peshawar, Pakistan. *Disaster medicine and public health preparedness*, *16* (3), 975–979. https://doi.org/10.1017/dmp.2020.438

Albahri, A.H., Alnaqbi, S.A., Alnaqbi, S.A., Alshaali, A.O., & Shahdoor, S.M. (2021). Knowledge, Attitude, and Practice Regarding COVID-19 Among Healthcare Workers in Primary Healthcare Centers in Dubai: A Cross-Sectional Survey, 2020. *Frontiers in public health*, *9*, 617679. https://doi.org/10.3389/fpubh.2021.617679

Alemu, T., Legesse, S., Abera, A., Amare, S., Maru, M., Shiferaw, B., Missaye, A., & Derseh, G. (2022). Health Professionals' Knowledge, attitude, and practices Regarding COVID-19 in Dessie City, Northeast Ethiopia: A Facility-Based Cross-Sectional Study. *Frontiers in public health*, *10*, 899808. https://doi.org/10.3389/fpubh.2022.899808

Alqahtani, J.S., Aldhahir, A.M., AlRabeeah, S.M., Alsenani, L.B., Alsharif, H.M., Alshehri, A.Y., Alenazi, M.M., Alnasser, M., Alqahtani, A.S., AlDraiwiesh, I.A., Alghamdi, S.M., Siraj, R.A., Alqahtani, H.S., Sreedharan, J.K., Alqahtani, A.S., & Alzahrani, E.M. (2022). Future Acceptability of Respiratory Virus Infection Control Interventions in General Population to Prevent Respiratory Infections. *Medicina (Kaunas, Lithuania)*, *58* (7), 838. https://doi.org/10.3390/medicina58070838

Alrubaiee, G.G., Al-Qalah, T., & Al-Aawar, M. (2020). Knowledge, attitudes, anxiety, and preventive behaviours towards COVID-19 among health care providers in Yemen: an online cross-sectional survey. *BMC public health*, *20* (1), 1541. https://doi.org/10.1186/s12889-020-09644-y

Alsaedi, A., Alharbi, M., Ossenkopp, J., Farahat, F., Taguas, R., Algarni, M., Alghamdi, A., Okdah, L., Alhayli, S., Alswaji, A., Doumith, M., El-Saed, A., Alzahrani, M., Alshamrani, M., & Alghoribi, M.F. (2022). Epidemiological and molecular description of nosocomial outbreak of COVID-19 Alpha (B.1.1.7) variant in Saudi Arabia. *Journal of infection and public health*, *15* (11), 1279–1286. Advance online publication. https://doi.org/10.1016/j.jiph.2022.10.007

Al-Tawfiq, J.A. & Auwaerter, P.G. (2019). Healthcare-associated infections: the hallmark of Middle East respiratory syndrome coronavirus with review of the literature. *The Journal of Hospital Infection*. 10 (1), 20-29. https://doi.org/10.1016/i.ihin.2018.05.021

Amro, F.M., Rayan, A.H., Eshah, N.F., & ALBashtawy, M.S.D. (2022). Knowledge, attitudes, and practices Concerning Covid-19 Preventive Measures Among Healthcare Providers in Jordan. *SAGE Open Nursing*, *8*, 23779608221106422.

Anguraj, S., Ketan, P., Sivaradjy, M., Shanmugam, L., Jamir, I., Cherian, A., & Sankar Sastry, A. (2021). The effect of hand hygiene audit in COVID intensive care units in a tertiary care hospital in South India. *American journal of infection control*, *49* (10), 1247–1251. https://doi.org/10.1016/j.ajic.2021.07.008

APA News (2020). Covid-19: Ghana goes on partial lockdown. 28 March 2020. [online]. htttp://www.apsnews.net/mobile/unelnterieure-EN, php?id=4938229 (Accessed February 11, 2021).

Asemahagn, M.A. (2020). 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):1–11. pmid:32839649

Ayinde, O.O., Usman B.A., Posi, A., Gbolahan, A. (2020) Cross-Sectional Study on Oyo State Health Care Worker's Knowledge, attitude, and practice regarding Corona Virus Disease 2019 (COVID-19) *Advances in Infectious Diseases*, *Vol.10 No.3*

Azer, S.A. (2020). Pathophysiology, diagnosis, complications and investigational therapeutics. *New Microbes and New Infections*, 37, 100738. https://doi, org/10.1016/jnmni.2020.100738 (Accessed 19 August 2021).

Badr, H., Oluyomi, A., Woodard, L., Zhang, X., Raza, S. A., Adel Fahmideh, M., El-Mubasher, O., & Amos, C. A. (2021). Sociodemographic and Health Belief Model Factors Associated with Nonadherence to COVID-19 Mitigation Strategies in the United States. *Annals of behavioral medicine: a publication of the Society of Behavioral Medicine*, *55* (7), 677–685. https://doi.org/10.1093/abm/kaab038

Barry, M., Phan, M.V., Akkielah, L., Al-Majed, F., Alhetheel, A., Somily, A., Alsubaie, S.S., McNabb, S.J., Cotten, M., Zumla, A., & Memish, Z.A. (2020). Nosocomial outbreak of the Middle East Respiratory Syndrome coronavirus: A phylogenetic, epidemiological, clinical and infection control analysis. *Travel medicine and infectious disease*, *37*, 101807. https://doi.org/10.1016/j.tmaid.2020.101807

Bashir, S., Alsultan, F., Iqbal, M., Alabdulkarim, N., Alammari, K., Almousa, A., Alsultan, A., Almousa, B., Albaradie, R., Mir, A., Al-Regaiey, K., Habib, S.S., & Abualait, T. (2021).

Healthcare workers' knowledge and attitudes towards COVID-19 in Saudi Arabia. *European review for medical and pharmacological sciences*, *25* (2), 1060–1069. https://doi.org/10.26355/eurrev_202101_24676

Bhagavathula, A.S., Aldhaleei, W.A., Rahmani, J., Mahabadi, A.M., & Bandari, D.K. (2020). Novel Coronavirus (COVID-19) knowledge and perceptions: A survey on healthcare workers. *JMIR Public Health and Surveillance,* 6 (2), 7-8. [online]. https://www.ncbi.nlm.nih.gov (Accessed: 16 July 2020).

Bitew, G., Sharew, M., & Belsti, Y. (2021). Factors associated with knowledge, attitude, and practice of COVID-19 among health care professional's working in South Wollo Zone Hospitals, Northeast Ethiopia. *SAGE open medicine*, *9*, 20503121211025147. https://doi.org/10.1177/20503121211025147

Bludau, A., Heinemann, S., Mardiko, A.A., Kaba, H.E.J., Leha, A., von Maltzahn, N., Mutters, N.T., Leistner, R., Mattner, F., & Scheithauer, S. (2022). Infection control strategies for patients and accompanying persons during the COVID-19 pandemic in German hospitals: a cross-sectional study in March-April 2021. *The Journal of hospital infection*, *125*, 28–36. https://doi.org/10.1016/j.jhin.2022.03.014

Bolisani, E. & Bratianu, C. (2018). Generic Knowledge Strategies. In: Emergent Knowledge Strategies. Knowledge Management and Organizational Learning, vol 4 Springer, Cham.

Brouwers, M.C., Kho, M.E., Browman, G.P., Burgers, J.S., Cluzeau, F., Feder, G., Fervers, B., Graham, I.D., Grimshaw, J., Hanna, S.E., Littlejohns, P., Makarski, J., & Zitzelsberger, L. (2017 f). or the AGREE Next Steps Consortium. AGREE II: Advancing guideline development, reporting and evaluation in healthcare. CMAJ 2017 ;182: E839-842.

Brown, K.M., Elliott, S.J., Leatherdale, S.T., & Robertson-Wilson, J. (2015). Searching for rigour in the reporting of mixed methods population health research: methodological review. *Health Education Research*, 30 (6 811-839) [online]. https://doi.org/10.1093/her/cyv046 (Assessed 20 May 2021).

Burdsall, D. (2020). Non-ventilator health care-associated pneumonia (NV-HAP): Long-term care. *American journal of infection control*, *48* (5S), A14–A16. https://doi.org/10.1016/j.ajic.2020.03.007

Calcagni, N., Venier, A.G., Nasso, R., Boudin, G., Jarrige, B., Parneix, P., & Quintard, B. (2023). Respiratory infection prevention: perceptions, barriers and facilitators after SARS -CoV-2. *Infection, disease & health*, *28* (1), 54–63. https://doi.org/10.1016/j.idh.2022.08.001

California Department of Public Health (2021). *Preventing Respiratory Infections in Skilled Nursing Facilities.* Training Manual U.S.A

Candevir, A., Üngör, C., Çizmeci Şenel, F., & Taşova, Y. (2021). How efficient are facial masks against COVID-19? Evaluating the mask use of various communities one year into the pandemic. *Turkish journal of medical sciences*, *51* (SI-1), 3238–3245. https://doi.org/10.3906/sag-2106-190

Carpenter, C.J. (2010). A meta-analysis of the effectiveness of Health Belief Model variables in predicting behaviour. *Health Communication,* 25 (8), 661-669.

Cascella, M., Rajnik, M., Cuomo, A., Dulebohn, S.C., & Di Napoli, R. (2020). ‘Features, evaluation and treatment coronavirus (COVID-19)’ [Updated 2020 Apr 6]. [Internet]. Treasure Island, (FL): StatPearls Publishing.

Chadsuthi, S.& Modchang, C. (2021) Modelling the effectiveness of intervention strategies to control COVID-19 outbreaks and estimating healthcare demand in Germany, Public Health in Practice (2), 100121, ISSN 2666-5352, https://doi.org/10.1016/j.puhip.2021.100121.

Cheng, C. W., Huang, P. Y., Wu, T. S., Huang, C. G., Tsao, K. C., Lin, C. S., Chung, T. Y., Lai, C. C., Yang, C. T., Chiu, C. H., & Infection Control Working Group (2021). Infection control operations of a large hospital in Taiwan to prevent nosocomial outbreaks during COVID-19 pandemic. *Biomedical journal*, *44* (6 Suppl 1), S8–S14. https://doi.org/10.1016/j.bj.2021.10.009

Cherry, K. (2021). ‘Attitude and Behavior in Psychology’ [online]. pp 6-7. https://www.verywellmind.com (Accessed: 21 February 2021).

Chiolero, A. & Buckeridge, D. (2020). Glossary for public health surveillance in the age of data science. Epidemiol Community Health 74:612-616.

Cohen, J. & Rodgers, Y.V.M. (2020). Contributing factors to personal protective equipment shortages during the COVID-19 pandemic. *Preventive medicine*, *141*, 106263. https://doi.org/10.1016/j.ypmed.2020.106263

Colquhoun, H.L., Levac, D.O.’., Brien, K.K., Straus, S., Tricco, A.C., Perrier, L., Kastner, M., & Moher, D. (2014). Scoping reviews: Time for clarity in definition, methods, and reporting. Journal of clinical Epidemiology, 67 (12), 1291-1294

Creamer, E.G. (2018). *An introduction to fully integrated mixed methods research*. SAGE Publications, Los Angeles, USA.

Creswell, J.W. & Clark, V.L.P. (2018). *Designing and conducting mixed methods research*. Third Edition, SAGE Publishers, Los Angeles, USA.

Creswell, J.W. (2015). *A Concise introduction to mixed methods research*. SAGE Publications Inc. London, UK.

Crnich, C.J. (2022). Reimagining Infection Control in U.S. Nursing Homes in the Era of COVID-19. *Journal of the American Medical Directors Association*, *23* (12), 1909–1915. https://doi.org/10.1016/j.jamda.2022.10.022

de Miranda Costa, M. M., Santana, H. T., Saturno Hernandez, P. J., Carvalho, A. A., & da Silva Gama, Z. A. (2020). Results of a national system-wide quality improvement initiative for the implementation of evidence-based infection prevention practices in Brazilian hospitals. *The Journal of hospital infection*, *105* (1), 24–34. https://doi.org/10.1016/j.jhin.2020.03.005

Department of Health, Republic of South Africa (2020). Practical Manual for Implementation of the National Infection Prevention and Control Strategic Framework. South Africa

Di Cola, S., Gazda, J., Lapenna, L., Ceccarelli, G., & Merli, M. (2023). Infection prevention and control programme and COVID-19 measures: Effects on hospital-acquired infections in patients with cirrhosis. *JHEP reports: innovation in hepatology*, *5* (5), 100703. https://doi.org/10.1016/j.jhepr.2023.100703

Donkor, B., K. (2020). Ashanti Region 97 health workers tested positive for Covid-19. 18 June 2020. [online]. https://www.graphic.com.gh/news/general-news/ashanti-region-97-health-workers-test-positive-for-covid-19.html

Doody, O., Slevin, E., & Taggart, L. (2013). Preparing for and conducting focus groups in nursing research, part 2. *British journal of nursing*, 22 (3):170-173.

Duncan, J. (2020). Two cases of coronavirus confirmed in Ghana. [Online]. Two cases of coronavirus confirmed in Ghana (citinewsroom.com) (Accessed: 15 July 2020).

Dunn, P.K. (2021). *Scientific research and methodology: An introduction to quantitative research in science and health.* https://bookdown.org/pkaldunn/Book Peter K. Dunn Sippy Downs, Australia.

Ejeh, F.E., Saidu, A.S., Owoicho, S., Maurice, N.A., Jauro, S., Madukaji, L., & Okon, K.O. (2020). Knowledge, attitude, and practice among healthcare workers towards COVID-19 outbreak in Nigeria. *Heliyon*, *6* (11), e05557. https://doi.org/10.1016/j.heliyon.2020.e05557

Ellertsson, S., Hlynsson, H. D., Loftsson, H., & Sigur Sson, E. L. (2023). Triaging Patients with Artificial Intelligence for Respiratory Symptoms in Primary Care to Improve Patient Outcomes: A Retrospective Diagnostic Accuracy Study. *Annals of family medicine*, *21* (3), 240–248. https://doi.org/10.1370/afm.2970

European Centre for Disease Prevention and Control. Considerations for IPC in relation to respiratory viral infections in healthcare settings. 6 February 2023. ECDC: Stockholm; 2023

Fan, Y., Zhang, S., Li, Y., et al. (2018). ‘Development and psychometric testing of knowledge, attitudes, and practices (KAP) questionnaire among student Tuberculosis (TB) patients (STB-KAPQ) in China. *BMC Infect Dis,* 18, 213. [online]. https://doi.org/10.1186/s12879-018-3122-9 (Accessed: 20 July 2020).

Fetansa, G., Etana, B., Tolossa, T., Garuma, M., Tesfaye Bekuma, T., Wakuma, B., Etafa, W., Fekadu, G., & Mosisa, A. (2021). Knowledge, attitude, and practice of health professionals in Ethiopia toward COVID-19 prevention at early phase. *SAGE open medicine*, *9*, 20503121211012220. https://doi.org/10.1177/20503121211012220

Frey, B.B. (2018). 'Pragmatic paradigm'. The SAGE Encyclopedia of Educational Research Measurement, and Evaluation. [online]. https://dx.doi.org/10.4135/9781506326139.n534

Ghana Health Service report. (2021) Ashanti Region Health Directorate.

Ghana Health Service report. (2020) 'COVID-19 pandemic update in Ghana' [Online]. https://ghanahealthservice.org/covid19/ (Accessed: 19 August 2020).

Ghana Health Service report. (2021) 'COVID-19 pandemic update in Ghana' [Online]. https://ghanahealthservice.org/covid19/ (Accessed: 20 June 2021).

Ghana News Agency (2021). 'Savlegu Hospital closedown over mass COVID-19 cases amongst Staff.' 22 February 2021. [online]. https://www.google.com/amp/s/www.omankyeame.info/news/savelugu-hospital-closed-down-over-mass-covid-19-cases-among-staff/amp/ (Accessed 23 February 2021).

Ghana Web (2021) 'Coronavirus: Medical facilities disregarding safety protocols-GRMNA'. 21 January 2021. [online]. https://www.ghanaweb, com/GhanaHomePage/NewsArchive/Coronavirus-Medical-facilities-disregarding-safety-protocols-GRNMA-1159978 (Accessed 24 March 2021)

Ghimire, P., Dhungel, S., & Pokhrel, A. (2020). Knowledge, attitude, and practice of healthcare workers towards coronavirus disease 2019 (COVID-19) pandemic. *J Nepal Health Res Counc*, *18* (2), pp.293-300.

Gilbert, R. & Cliffe, S.J. (2016). Public Health Surveillance. Public Health Intelligence: Issues of Measure and Method, 91–110. https://doi.org/10.1007/978-3-319-28326-5_5

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British dental journal,* 204 (6):291-295.

Glowicz, J.B., Landon, E., Sickbert-Bennett, E.E., Aiello, A.E., deKay, K., Hoffmann, K.K., Maragakis, L., Olmsted, R.N., Polgreen, P.M., Trexler, P.A., VanAmringe, M.A., Wood, A.R., Yokoe, D., & Ellingson, K.D. (2023). SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. *Infection control and hospital epidemiology*, *44* (3), 355–376. https://doi.org/10.1017/ice.2022.304

Ghana Medical Association Report (2020). 'Over 200 doctors hit with Corona virus-GMA'. *Starr FM,* 14 July 2020. [online]. GMA (ghanaweb.com) (Accessed 18 February 2021).

Ghana Medical Association Report. (2021). 'COVID-19: 7 doctors dead in Ghana'. *Pulse News,* 1 February 2021. [online]. http://www.pulse.com.gh. (Accessed 20 February 2021).

Goldkuhl, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems,* 135-146.

Gopalakrishnan, S., Kandasamy, S., Abraham, B., Senthilkumar, M., & Almohammed, O.A. (2021). Knowledge, attitudes, and practices Associated with COVID-19 Among Healthcare Workers in Hospitals: A Cross-Sectional Study in India. *Frontiers in public health*, *9*, 787845. https://doi.org/10.3389/fpubh.2021.787845

Grove, S.K. (2017). *Sampling. In The practice of nursing research: Appraisal, synthesis, and generation of evidence*. Ed by Gray, JR, Grove, SK and Sutherland, S. Elsevier, St. Louis, Missouri, USA, 329-362.

Hamid, A.H., Azmawati, A.A., Ahmad, J.H., & Hasan, N.N.N. (2014). *Communication and environment: Sustainability and risk*. Penerbit Universiti Sains, Malaysia.

Han, B. & Hoang, B.X. (2020). Opinions on the current pandemic of COVID-19: Use functional food to boost our immune functions. *Journal of infection and public health*, *13* (12), 1811–1817. https://doi.org/10.1016/j.jiph.2020.08.014

Haque, M., Sartelli, M., Mckimm, J., & Bakar, A.M. (2018). Health care-associated infections - an overview. *Infect Drug Resis*, 11, 2321-2333.

Health Protection Surveillance Centre (2023). Public Health & Infection Prevention & Control Guidelines on the Prevention and Management of Cases and Outbreaks of COVID-19, Influenza& Other Respiratory Infections in Residential Care Facilities. Health Service Executive Ireland.

HEPACART. (2021) '4 Best Practices for Preventing Healthcare-Associated Infections' retrieved from https://www.hepacart.com/blog/4-best-practices-for-preventing-healthcare-associated-infections Accessed on 25 May 2023

Hope, E.K. (2020). 30 health workers in Ashanti region contract covid-19. Ghanaian Times 21 May 2020. [online]. http://www.ghanaiantimes.com.gh (Accessed: 18 July 2020).

Houghton, C., Meskell, P., Delaney, H., Smalle, M., Glenton, C., Booth, A., Chan, X.H.S., Devane, D., & Biesty, L.M. (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 Syst Rev*, 21.4 (4):CD013582, 11-17. 10.1002/14651858.CD013582. (Accessed 20 February 2021).

Hu, S. (2014). Study Population. In: Michalos, A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_2893

Hussain, I., Majeed, A., Imran, I., Ullah, M., Hashmi, F.K., Saeed, H., Chaudhry, M.O., & Rasool, M.F. (2021). Knowledge, attitudes, and practices Toward COVID-19 in Primary Healthcare Providers: A Cross-Sectional Study from Three Tertiary Care Hospitals of Peshawar, Pakistan. *Journal of community health*, *46* (3), 441–449. https://doi.org/10.1007/s10900-020-00879-9

Hutchinson, N.T., Steelman, A., & Woods, J.A. (2020). Behavioral strategies to prevent and mitigate COVID-19 infection. *Sports medicine and health science*, *2* (3), 115–125. https://doi.org/10.1016/j.smhs.2020.09.001

Iddir, M., Brito, A., Dingeo, G., Fernandez Del Campo, S.S., Samouda, H., La Frano, M.R., & Bohn T. (2020) Strengthening the Immune System and Reducing Inflammation and Oxidative Stress through Diet and Nutrition: Considerations during the COVID-19 Crisis. *Nutrients*.12 (6):1562. https://doi.org/10.3390/nu12061562

Jamil, K.F., Winardi, W., Yufika, A., Anwar, S., Librianty, N., Prashanti, N.A., Sari, T.N., Utomo, P.S., Dwiamelia, T., Natha, P.P., Salwiyadi, S., Asrizal, F.W., Ikram, I., Wulandari, I., Haryanto, S., Fenobileri, N., Wagner, A.L., Mudatsir, M., & Harapan, H. (2020). Knowledge of coronavirus disease 2019 (COVID-19) among healthcare providers: A cross-sectional study in Indonesia. *Asia Pac J Trop Med* 13:402-8

Jang, W., Kim, B., Kim, E.S., Song, K.H., Moon, S.M., Lee, M.J., Park, J.Y., Kim, J.Y., Shin, M.J., Lee, H., & Kim, H.B. (2022). Differences in strategies for prevention of COVID-19 transmission in hospitals: nationwide survey results from the Republic of Korea. *The Journal of Hospital Infection*, *129*, 22–30. https://doi.org/10.1016/j.jhin.2022.07.032

Jawhara, S. (2020). How to boost the immune defence prior to respiratory virus infections with the special focus on coronavirus infections. *Gut Pathog* **12**, 47 https://doi.org/10.1186/s13099-020-00385-2

Jemal, B., Aweke, Z., Mola, S., Hailu, S., Abiy, S., Dendir, G., Tilahun, A., Tesfaye, B., Asichale, A., Neme, D., Regasa, T., Mulugeta, H., Moges, K., Bedru, M., Ahmed, S., & Teshome, D. (2021). Knowledge, attitude, and practice of healthcare workers toward COVID-19 and its prevention in Ethiopia: A multicenter study. *SAGE open medicine*, *9*, 20503121211034389. https://doi.org/10.1177/20503121211034389

Johnson, G., Scholes, K., & Whittington, R. (2008). *Exploring Corporate Strategy*.8th edn Pearson Education Limited, London 1-29

Joseph, B. & Joseph, M. (2016). The health of the healthcare workers. *Indian Journal of Occupational and Environmental Medicine*, *20* (2), 71–72. [online]. https://doi.org/10.4103/0019-5278.197518 (Accessed 18 February 2021).

Kaliyaperumal, K. (2004). Guidelines for conducting knowledge, attitude, and practice study. Diabetic Retinopathy project, 4 (1), 7-9.

Kamacooko, O., Kitonsa, J., Bahemuka, U.M., Kibengo, F.M., Wajja, A., Basajja, V., Lumala, A., Kakande, A., Kafeero, P., Ssemwanga, E., Asaba, R., Mugisha, J., Pierce, B.F., Shattock, R.J., Kaleebu, P., & Ruzagira, E. (2021). Knowledge, Attitudes, and Practices Regarding COVID-19 among Healthcare Workers in Uganda: A Cross-Sectional Survey. *International journal of environmental research and public health*, *18* (13), 7004. https://doi.org/10.3390/ijerph18137004

Kamali Haghighi F, Kouhi P, Amini M, Mohammadkarimi V, Sepehrpoor M, Hosseini S.A., Moosavi, M., & Boogar, S.S (2020). Knowledge, attitude, and practice toward COVID-19 among healthcare workers in Shiraz, Iran *Shiraz E-Med J.* 21 (12). 1-8. doi: 10.5812/semj.108872

Kanu, S., James, P.B., Bah, A.J., Kabba, J.A., Kamara, M.S., Williams, C., & Kanu, J.S. (2021). Healthcare Workers' Knowledge, Attitude, Practice and Perceived Health Facility Preparedness Regarding COVID-19 in Sierra Leone. *Journal of multidisciplinary healthcare*, *14*, 67–80. https://doi.org/10.2147/JMDH.S287156

Karam, K.A., Hota, P., Mora, S.J., Lowell, A., McKay, K., Xian, X., Patel, B., & Forzani, E. (2021). Development of a new aerosol barrier mask for mitigation of spread of SARS-CoV -2 and other infectious pathogens. *Respiratory medicine*, *181*, 106381. https://doi.org/10.1016/j.rmed.2021.106381

Karlsson, U. & Fraenkel, C. (2020). Covid-19: risks to healthcare workers and their families. *BMJ* 371:m3944. [online]. doi:10.1136/bmj.m3944 (Accessed 20 April 2021).

Kassie, B.A., Adane, A., Tilahun, Y.T., Kassahun, E.A., Ayele, A.S., & Belew, A.K. (2020). Knowledge and attitude towards COVID-19 and associated factors among health care providers in Northwest Ethiopia. *PloS one*, *15* (8), e0238415.

Kaushik & Walsh, C.A. (2019). Pragmatism as a research paradigm and its implications for social work research, *Journal of Social Science*, 55 (8), 1-5. [online]. https://doi:103390/socsci8090255 (Assessed 19 June 2021).

Kenny, P. (2020). 90, 000 healthcare workers infected with COVID-19: ICN. https://www.aa.com.tr/en/europe/90-000-healthcare-workers-infected-with-covid-19-icn/1831765. (Accessed 20 February 2021)

Kesmodel, U.S. (2018). Cross-sectional studies-what are they good for? *Acta obstericia et gynaecologica* Scandinavia, 97 (4), 388-393. https://doi.og/1111/aogs.13331

Kitt, E., Handy, L. K., Coffin, S. E., & Healthcare-Associated Viral Infection Harm Prevention Team (2023). Response to: What will be the precaution for healthcare-associated rhinovirus infection outbreaks? *American journal of infection control*, *51* (3), 359. https://doi.org/10.1016/j.ajic.2022.10.011

Krueger, R.A. & Casey, M.A. (2015). Focus groups: a practical guide for applied research. 5th ed. Thousand Oaks, Calif.: Sage.

Kumar, R., Singh, V., Mohanty, A., Bahurupi, Y., & Gupta, P.K. (2021). Corona health-care warriors in India: knowledge, attitudes, and practices during COVID-19 outbreak. *Journal of education and health promotion*, *10*, 44. https://doi.org/10.4103/jehp.jehp_524_20

Kunno, J., Yubonpunt, P., Supawattanabodee, B., Wiriyasirivaj, B., & Sumanasrethakul, C. (2022). Covid-19 knowledge, attitudes, and practices among healthcare workers in urban community Bangkok, Thailand. *Roczniki Panstwowego Zakladu Higieny*, *73* (1), 17–26. https://doi.org/10.32394/rpzh.2022.0200

Kusi, H. (2012). *Doing qualitative research: A guide for researchers*. Emmpong Press, New Town, Accra, Ghana.

Lee, I.K., Wang, C.C., Lin, M.C., Kung, C.T., Lan, K.C., & Lee, C.T. (2020). Effective strategies to prevent coronavirus disease-2019 (COVID-19) outbreak in hospital. *The Journal of Hospital Infection*, *105* (1), 102–103. https://doi.org/10.1016/j.jhin.2020.02.022

Li, K.K.F., Jarvis, S.A., & Minhas, F. (2021). Elementary effects analysis of factors controlling COVID-19 infections in computational simulation reveals the importance of social distancing and mask usage. *Computers in biology and medicine*, *134*, 104369. https://doi.org/10.1016/j.compbiomed.2021.104369

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., et al. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 382:1199–1207. [online]. doi: 10.1056/NEJMoa2001316 (Accessed 14 February 2021).

Lim, Rachel & Htun, Htet Lin & Li, Anthony & Huiling, Guo & Kyaw, Win Mar & Aung Hein, Aung & Ang, Brenda & Chow, Angela. (2022). Fending off Delta – Hospital measures to reduce nosocomial transmission of COVID-19. *International Journal of Infectious Diseases*. 117. 10.1016/j.ijid.2022.01.069.

Limbu, D.K., Piryani, R.M., & Sunny, A.K. (2020). Healthcare workers ' knowledge, attitudes, and practices during the COVID-19 pandemic response in a tertiary care hospital of Nepal. *Plos one,* 15 (11) e0242126. [online]. https://doi.org/10.1371/journal.pone.0242126 (Accessed 20 February 2021).

Lu, D., Wang, H., Yu, R., Yang, H., & Zhao, Y. (2020). Integrated infection control strategy to minimize nosocomial infection of coronavirus disease 2019 among ENT healthcare workers. *The Journal of hospital infection*, *104* (4), 454–455. https://doi.org/10.1016/j.jhin.2020.02.018

Lukito, W. (2021). Current Evidence in Water and Hydration Science. *Ann Nutr Metab* 77 (Suppl. 4): 1–6. https://doi.org/10.1159/000521769

Malik, U.R., Atif, N., Hashmi, F.K., Saleem, F., Saeed, H., Islam, M., Jiang, M., Zhao, M., Yang, C., & Fang, Y. (2020). Knowledge, attitudes, and practices of Healthcare Professionals on COVID-19 and Risk Assessment to Prevent the Epidemic Spread: A Multicenter Cross-Sectional Study from Punjab, Pakistan. *International journal of environmental research and public health*, *17* (17), 6395. https://doi.org/10.3390/ijerph17176395

Maltezou, H.C., Dounias, G., Rapisarda, V., & Ledda, C. (2022). Vaccination policies for healthcare personnel: Current challenges and future perspectives. *Vaccine: X*, *11*, 100172. https://doi.org/10.1016/j.jvacx.2022.100172

Maseko, T.N., Huang, H.-C., & Lin, K.C. (2019). Cervical cancer screening behaviour of African women: The Rosenstock Health Belief Model assessment. *Health Care for Women International*, 1-12, https://doi.org/10.1080/07399332.2019.1677665

Mendoza Millan, D. L., Stevens Carrion-Nessi, F., Mejia Bernard, M. D., Victoria Marcano -Rojas, M., Omana Avila, O. D., Doval Fernandez, J. M., Chacon Labrador, F. R., Quintero Rodriguez, A., Gasparini Vega, S., Tami, A., Maricuto, A. L., Velasquez, V. L., Eugenia Landaeta, M., Figuera, M., Chavero, M., Figuera, L., Camejo-Avila, N. A., & Forero-Pena, D. A. (2021). Knowledge, Attitudes, and Practices Regarding COVID-19 Among Healthcare Workers in Venezuela: An Online Cross-Sectional Survey. *Frontiers in public health*, 9, 1-10. [633723]. https://doi.org/10.3389/fpubh.2021.633723

Ministry of Health (2020). Provisional standard treatment guidelines for Novel coronavirus infection for Ghana, Drug policy unit. Accra.

Mintzberg, H. (1978). Patterns in strategy formation. *Management science,* 24 (9):934-948.

Mitchell. (2018). *Ontological pragmatism*. (Doctoral thesis). https://doi.org/10.17863/CAM.25534

Moodley, S.V., Zungu, M., Malotle, M., Voyi, K., Claassen, N., Ramodike, J., Thunzi, N., & Mlangeni, N. (2021). A health worker knowledge, attitudes and practices survey of SARS-CoV-2 infection prevention and control in South Africa. *BMC infectious diseases*, *21* (1), 138. https://doi.org/10.1186/s12879-021-05812-6

Morgan, & David L, (2014). Integrating qualitative and quantitative methods: A pragmatic approach. SAGE Publications, Thousand Oaks, USA.

Mouallem, R.E., Moussally, K., Williams, A., Repetto, E., Menassa, M., Martino, C., & Sittah, G.A. (2021). How COVID-19 highlighted the need for infection prevention and control measures to become central to the global conversation: experience from the conflict settings of the Middle East. *International journal of infectious diseases: IJID: official publication of the International Society for Infectious Diseases*, *111*, 55–57. https://doi.org/10.1016/j.ijid.2021.08.034

Munteanu, C. & Schwartz, B. (2022). The relationship between nutrition and the immune system. *Frontiers in nutrition*, *9*, 1082500. https://doi.org/10.3389/fnut.2022.1082500

Negera, A., Hailu, C., & Birhanu, A. (2022). Practice towards Prevention and Control Measures of Coronavirus Disease and Associated Factors among Healthcare Workers in the Health Facilities of the Horo Guduru Wollega Zone, West Ethiopia, 2021. *Global health, epidemiology and genomics*, *2022*, 1973502. https://doi.org/10.1155/2022/1973502

National Health Service [NHS] (2022). Respiratory virus infections Including COVID-19: Infection Prevention and Control (IPC) Guidance. Harrogate and District NHS Foundation Trust | Version 5. United Kingdom

Nepal, R., Sapkota, K., Adhikari, K., Paudel, P., Adhikari, B., Paudyal, N., & Nepal, R. (2020). Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Chitwan, Nepal.

Niederman, M.S. & Torres, A. (2022). Respiratory infections. European respiratory review: *an official journal of the European Respiratory* Society, 31 (166), 220150.htt://doi.org/10.1183/16000617.0150-2022

Nkansah, C., Serwaa, D., Adarkwah, L.A., Osei-Boakye, F., Mensah, K., Tetteh, P., Awudu, S., & Apodola, A. (2020). Novel coronavirus disease 2019: knowledge, practice and preparedness: a survey of healthcare workers in Offinso-North District, Ghana. *Pan African Medical Journal* 35 (Suppl 2), 79. pp 1-6. [online]. https://doi.org/10.11604/pamj.supp.2020.35.2.23644 (Accessed 26 June 2021).

Ochie, C.N., Aniwada, E.C., Uchegbu, E.K., Asogwa, T.C., & Onwasoigwe, C.N. (2022). Infection prevention and control: knowledge, determinants and compliance among primary healthcare workers in enugu metropolis, south-east nigeria. *Infection prevention in practice*, *4* (2), 100214. https://doi.org/10.1016/j.infpip.2022.100214

Ogolodom, M.P., Mbaba, A.N., Alazigha, N., Erondu, O.F., Egbe, N.O., et al. (2020). ‘Knowledge, attitude and fears of healthcare workers towards the Corona Virus Disease (COVID-19) Pandemic in South-South Nigeria. *Health Sci J.* Sp. Iss 1. [online]. doi:10.36648/1791-809X.S1.002 (Accessed 20 February 2021).

Olum, R., Chekwech, G., Wekha, G., Nassozi, D.R., & Bongomin, F. (2020). Coronavirus Disease-2019: Knowledge, attitudes, and practices of healthcare workers at Makerere University Teaching Hospitals, Uganda. *Front. Public Health,* 8 181.pp 1-8 [online] Available at doi: 10.3389/fpubh.2020.00181 (Accessed 6 February 2021).

Ontario Agency for Health Protection and Promotion (Public Health Ontario), Provincial Infectious Diseases Advisory Committee. Best practices for prevention, surveillance and infection control management of novel respiratory infections in all health care settings. 1 st revision. Toronto, ON: Queen's Printer for Ontario; 2020.

Osula, V.O., Sanders, J.E., Chakare, T., Mapota-Masoabi, L., Ranyali-Otubanjo, M., Hansoti, B., & McCollum, E.D. (2022). COVID-19 advanced respiratory care educational training programme for healthcare workers in Lesotho: an observational study. *BMJ open*, *12* (4), e058643. https://doi.org/10.1136/bmjopen-2021-058643

Peters, M.D.J., Marnie, C., Tricco, A.C., Pollock, D., Munn, Z., Alexander, L., McInerney, P., Godfrey, C.M., & Khalil, H. (2020). Scoping methodological guidance for the conduct of scoping reviews. *JBI Evidence Synthesis*, 18 (10), 2119-2126.

Petrie, J.G. & Talbot, T.R. (2021). Health Care-Acquired Viral Respiratory Diseases. *Infectious disease Clinics of North America*, *35* (4), 1055–1075. https://doi.org/10.1016/j.idc.2021.07.007

Piret, J. & Boivin, G. (2020). Pandemics throughout history. *Frontiers in Microbiology*, 11 (631736), 1-16.

Polit, D.F. & Beck, C.T. (2018). *Essentials of nursing research: Appraising evidence for nursing practice*. 9th edition. Wolters Kluwer, Philadelpia, USA

Polit, D.F. & Beck, C.T. (2014). *Essentials of nursing Research: Appraising evidence for nursing practice*. 8th Edition, Lippincott Williams & Wilkins, Philadelphia, USA.

Pollock, D., Davies, E.L., Peters, M.D.J., Tricco, C., Alexander, L., McInerney, P., Godfrey, C.M., Khali, H., & Munn, Z. (2021). Undertaking a scoping review: A practical guide for nursing and midwifery students, clinicians, researchers, and academics. *Journal of Advanced Nursing*, 77, 2012-2113.

Pretorius, M. (2008).” When Porter’s generic strategies are not enough: complementary strategies for turnaround situations” *Journal of Business Strategy,* 29 (6), 19-28.

Public Health Agency Northern Ireland. (2023). *infection prevention and control measures for respiratory illnesses*. Northern Ireland Regional infection prevention and control manual.

Public Health Agency of Canada. (2023). 'Reduced the spread of respiratory viruses'. Retrieved from https://www.canada.ca/en/public-health/services/diseases/prevent-spread-respiratory-viruses.html (Accessed 25 May 2023).

Rabbani, U., & AL Saigul, A.M. (2021). Knowledge, attitude, and practices of Health Care Workers about Corona Virus Disease 2019 in Saudi Arabia. *Journal of epidemiology and global health*, *11* (1), 60–68. https://doi.org/10.2991/jegh.k.200819.002

Redmond, R., & Curtis, E. (2009). Focus groups: principles and process. *Nurse researcher*, *16*(3), 57–69. https://doi.org/10.7748/nr2009.04.16.3.57.c6946

Rosenstock, I.M., Strecher, V.J., & Becker, M.H. (1988). 'Social learning theory and the Health Belief Model'. *Health Education Quarterly*, 15 (2), 175-183.

Salman, M., Mustafa, Z., Asif, N., Zaidi, H.A., Shehzadi, N., Khan, T.M., Saleem, Z., & Hussain, K. (2020). Knowledge, attitude and preventive practices related to COVID-19 among health professionals of Punjab province of Pakistan. *Journal of infection in developing countries*, *14* (7), 707–712. https://doi.org/10.3855/jidc.12878

Sandaradura, I., Goeman, E., Pontivivo, G., Fine, E., Gray, H., Kerr, S., Marriott, D., Harkness, J., & Andresen, D. (2020). A close shave? Performance of P2/N95 respirators in healthcare workers with facial hair: results of the BEARDS (BEnchmarking Adequate Respiratory Defence) study. *The Journal of Hospital Infection*, *104*(4), 529–533. https://doi.org/10.1016/j.jhin.2020.01.006

Saqlain, M., Munir, M.M., Rehman, S.U., Gulzar, A., Naz, S., Ahmed, Z., Tahir, A.H., & Mashhood, M. (2020). Knowledge, attitude, practice and perceived barriers among healthcare workers regarding COVID-19: a cross-sectional survey from Pakistan, *Journal of Hospital Infection,* Volume 105, Issue 3, 419-423

Schwartz, N.E. (1976). Nutrition knowledge, attitudes and practices of Canadian public health nurses. Journal of Nutrition Education, 8(2): 28-31

Setia, S.M. (2016). Methodology Series Module 3: Cross–Sectional studies. *Indian J Dermatol,* 61 (3):261-264. doi:10.4103/0019-5154.182410

Shah, A.S.V., Wood, R., Gribben, C., Caldwell, D., Bishop, J., Weir, A., et al. (2020). Risk of hospital admission with coronavirus disease 2019 in healthcare workers and their households: nationwide linkage cohort study. *BMJ,* 371, 3582. [online]. doi:101136/bmj.m3582 (Accessed 20 May 2021).

Shared health. (2023). Infection Prevention and Control Outbreak Management Guidelines Respiratory (Including Influenza and COVID-19) and Gastrointestinal. Shared Health Sions Canada.

Shi, H., Han, X., Jiang, N., Cao, Y., Alwalid, O., Gu, J., et al. (2020). Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis*. 20:425–34. [online]. doi: 10.1016/S1473-3099 (20)30086-4 (Accessed 10 February 2021).

Simpson, R.J., Campbell, J.P., Gleeson, M., Krüger, K., Nieman, D.C., Pyne, D.B., Turner, J.E., & Walsh, N.P. (2020). Can exercise affect immune function to increase susceptibility to infection? *Exercise immunology review*, *26*, 8–22.

Stempliuk, V. (2022). Prevention of healthcare-associated respiratory tract infections (HA -RTI). Powerpoint presentation WHO Libraries.

Tamang, N., Rai, P., Dhungana, S., Sherchan, B., Shah, B., Pyakurel, P., & Rai, S. (2020). COVID-19: A National Survey on perceived level of knowledge, attitude, and practice among frontline healthcare Workers in Nepal. *BMC public health*, *20* (1), 1905. https://doi.org/10.1186/s12889-020-10025-8

Tappen, R. (2016). *Advanced nursing research: From theory to practice*. 2nd Edition. Burlington, MA, USA.

Tarkang, E.E. &. Zotor, F.B. (2015). Application of the Health Belief Model (HBM) in HIV prevention: A literature review. *Central African Journal of Public Health,* 1 (1), 1-8. doi: 10.11648/j.cajph.20150101.11 (Accessed 19 February 2021).

Tashkandi, N., Aljuaid, M., McKerry, T., Alchin, J., Taylor, L., Catangui, E.J., Mulla, R., Sinnappan, S., Nammour, G., El-Saed, A., & Alshamrani, M.M. (2021). Nursing strategic pillars to enhance nursing preparedness and response to COVID-19 pandemic at a tertiary care hospital in Saudi Arabia. *Journal of infection and public health*, *14* (9), 1155–1160. https://doi.org/10.1016/j.jiph.2021.06.016

Taylor, M. (2023). ‘CDC publishes ventilation guidance for respiratory infections’ retrieved from https://www.beckershospitalreview.com/infection-control/cdc-publishes-ventilation-guidance-for-respiratory-infection.Accessed on 25 May, 2023

Thibon, P., Breton, P., Mouet, A., Bidon, A., Haupais, F., Darrigan, C., Gautier, P., Letourneur, T., Perillieux, E., Seguineau, C., Thibon, P., Henry, L., Ar Gouilh, M., Borgey, F., Le Hello, S., & ECRAN Investigation group (2021). Healthcare associated coronavirus disease 2019 among health care workers in Normandy, France: a multi-center study. *Infection prevention in practice*, *3* (1), 100109. https://doi.org/10.1016/j.infpip.2020.100109

Tian, S., Hu, N., Lou, J., Chen, K., Kang, X., Xiang, Z., et al. (2020). Characteristics of COVID-19 infection in Beijing. *J Infect,* 80, 401–6. [online]. doi: 10.1016/j.jinf.2020.02.018 (Accessed 10 February 2021).

Tien, T.Q., Tuyet-Hanh, T.T., Linh, T., Hai Phuc, H., & Van Nhu, H. (2021). Knowledge, Attitudes, and Practices Regarding COVID-19 prevention among Vietnamese Healthcare Workers in 2020. *Health services insights*, *14*, 11786329211019225. https://doi.org/10.1177/11786329211019225

Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D., Moher, D., Peters, M.D.J., Horsley, T., Weeks, L., Hempel, S., Akl, E.A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M.G., Garritty, C., Lewin, S., & Straus, S.E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine*, *169* (7), 467–473. https://doi.org/10.7326/M18-0850

Tricco, A., Lillie, E., Zarin, W., et al. (2016). A scoping review on the conduct and reporting of scoping reviews. *BMC Med Res Methodol* 16, 15

Tsiga-Ahmed, F.I., Amole, T.G., Musa, B.M., Nalado, A.M., Agoyi, O.B., Galadanci, H.S., & Salihu, H.M. (2021). COVID 19: Evaluating the Knowledge, Attitude and Preventive Practices of Healthcare Workers in Northern Nigeria. *International journal of MCH and AIDS*, *10* (1), 88–97. https://doi.org/10.21106/ijma.418

Ul Haq, N., Hassali, M.A, Shafie, A.A. et al. (2012). Cross sectional assessment of knowledge, attitude, and practice towards Hepatitis B among healthy population of Quetta, Pakistan. *BMC Public Health,* 12,692. https://doi,org/10.1186/1471-2458-12-692 (Assessed 17 August 2021).

Vicentini, C., Garzaro, G., Cornio, A.R., Bosio, D., Bergamaschi, E., Parravicini, G.P., & Zotti, C.M. (2023). The Italian policy of mandating SARS-CoV-2 vaccination for healthcare workers: Analysis of the policy processes and preliminary outcomes. *Health policy (Amsterdam, Netherlands)*, *128*, 49–54. https://doi.org/10.1016/j.healthpol.2022.11.006

Vimercati, L., Dell'Erba, A., Migliore, G., De Maria, L., Caputi, A., Quarato, M., Stefanizzi, P., Cavone, D., Ferorelli, D., Sponselli, S., Mansi, F., & Tafuri, S. (2020). Prevention and protection measures of healthcare workers exposed to SARS-CoV-2 in a university hospital in Bari, Apulia, Southern Italy. *The Journal of Hospital Infection*, *105* (3), 454–458. https://doi.org/10.1016/j.jhin.2020.05.024

Vu, T.T., Van Horn, L., Achenbach, C.J., Rydland, K.J., & Cornelis, M.C. (2022). Diet and Respiratory Infections: Specific or Generalized Associations. *Nutrients*, *14* (6), 1195. https://doi.org/10.3390/nu14061195

Wee, L.E., Venkatachalam, I., Sim, X.Y.J., Tan, K.B., Wen, R., Tham, C.K., Gan, W.H., Ko, K.K.K., Ho, W.Q., Kwek, G.T.C., Conceicao, E.P., Sng, C.Y.E., Ng, X.H.J., Ong, J.Y., Chiang, J.L., Chua, Y.Y., Ling, M.L., Tan, T.T., & Wijaya, L. (2021). Containment of COVID-19 and reduction in healthcare-associated respiratory viral infections through a multi-tiered infection control strategy. *Infection, disease & health*, *26* (2), 123–131. https://doi.org/10.1016/j.idh.2020.11.004

WHO. (2003). *Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003.* https://www. who.int/csr/sars/country/table2004_04_21/en/. (Accessed February 11 2021).

WHO. (2019). *WHO MERS global summary and assessment of risk.* https://apps.who.int/iris/bitstream/handle/10665/326126/WHO-MERS-RA-19.1-eng.pdf?ua=1. (Accessed February 11 2021).

Wilson, A.M., Sleeth, D.K., Schaefer, C., & Jones, R.M. (2022). Transmission of Respiratory Viral Diseases to Health Care Workers: COVID-19 as an Example. *Annual review of public health*, *43*, 311–330. https://doi.org/10.1146/annurev-publhealth-052120-110009

Winkler, M.L., Hooper, D.C., & Shenoy, E.S. (2022). Infection Prevention and Control of Severe Acute Respiratory Syndrome Coronavirus 2 in Health Care Settings. *Infectious disease clinics of North America*, *36* (2), 309–326. https://doi.org/10.1016/j.idc.2022.01.001

Wong, L.P., Alias, H., Wong, P.-F., Lee, H.Y., & AbuBakar, S. (2020). Using the Health Belief Model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Human Vaccines and Immunotherapeutics*, 14 (9), 2204-2214.

World Health Organization [WHO] (2020 a). *Naming the coronavirus disease (COVID-19) and the virus that causes it.* World Heal Organ [Internet]. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease- (covid-2019)-and-the-virus-that-causes-it

World Health Organization [WHO] (2020b). WHO announces COVID-19 outbreak a pandemic.[online].http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic (Accessed: 12 March 2020).

World Health Organization [WHO]. (2020d). Protocol for assessment of potential risk factors for Coronavirus Disease 2019 (COVID-19) among health workers in a health care setting. 23 March 2020. (Accessed 11 February 2021).

World Health Organization [WHO] (2020c). Covid-Strategy-Update - 14 April 2020'. https://www.who.int/publications/m/item/covid-19-strategy-update. (Accessed: 11 February 2021).

World Health Organization [WHO]. (2020e). *Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected: Interim guidance.* [online]. https://www.who.int/publications/i/item/10665-331495 (Accessed: 17 July 2020).

World Health Organization[WHO] (2020f). Coronavirus disease (COVID-2019) situation reports. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports. (Accessed: 17 July 2020).

World Health Organisation[WHO] (2020g) Healthcare-associated infections FACT SHEET. Retrieved from https://www.convatec.at/media/1286/gpsc_ccisc_fact_sheet_en.pdf accessed 30 May 2023

World Health Organization. (2021). Infection prevention and control during health care when COVID-19 is suspected or confirmed. WHO/2019-nCoV/IPC/2020.4

Yamaguto, F., Zhen, M.M., Moreira, B.M., Montesanti, Raboni, S.M. (2022). Community respiratory viruses and healthcare-associated infections: epidemiological and clinical aspects, *Journal of Hospital Infection,* 122, 187-193, doi.org/10.1016/j.jhin.2022.01.009.

Yesse, M., Muze, M., Kedir, S., Argaw, B., Dengo, M., Nesre, T., Hamdalla, F., Saliha, A., Mussa, T., Kasim, I., Kedir, A., Delebo, T., Sunkemo, A., Badeg, Y., Ensarmu, D., Abebe, D., Dessalegn, A., & Ayelign, H. (2021). Assessment of knowledge, attitude, and practice toward COVID-19 and associated factors among health care workers in Silte Zone, Southern Ethiopia. *PloS one*, *16* (10), e0257058. https://doi.org/10.1371/journal.pone.0257058

Zhang, M., Zhou, M., Tang, F., Wang, Y., Nie, H., Zhang, L., & You, G. (2020). Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. *The Journal of hospital infection*, *105* (2), 183–187. https://doi.org/10.1016/j.jhin.2020.04.012

Zhiruo, Z., Shelan, L., Mi, Xi., Shijian, L., Dahai, Z., Chaolin, H. & Saijuan, C. (2020). Protecting healthcare personnel from 2019-nCoVinfection risk: Lessons and suggestions'. *Front. Med,* 14 (2), 229-231. https://doi.org/10.1007/s11684-020-0765-x (Accessed: 20 May 2021).

Zhong, B.L., Luo, W., Li, H.M., Zhang, Q.Q., Liu, X.G., Li, W.T., & Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *International Journal of Biological Sciences*, *16* (10), 1745–1752. [online]. https://doi.org/10.7150/ijbs.45221 (Accessed 14 July 2020).

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

APPENDICES

APPENDIX A

RESEARCH ETHICS COMMITTEE APPROVAL

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 18 March 2022 and Expires 18 March 2027.
- IORG #: IORG0001762 OMB No. 0990-0279 Approved for use through June 30, 2025 and Expires 07/28/2026.

Faculty of Health Sciences **Research Ethics Committee**

17 August 2023

Approval Certificate
Annual Renewal

Dear Mrs AS Ofosu,

Ethics Reference No.: 357/2022 – Line 1
Title: Evaluating the Knowledge, Attitude and Practice of Ghanaian Healthcare Workers to inform strategies to prevent healthcare-associated spread of Respiratory Infections

The **Annual Renewal** as supported by documents received between 2023-07-12 and 2023-08-16 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2023-08-16 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Renewal of ethics approval is valid for 1 year, subsequent annual renewal will become due on 2024-08-17.
- Please remember to use your protocol number (357/2022) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Professor C Kotzé
MBChB, DMH, MMed(Psych), FCPsych, Phd
Acting Chairperson: *Faculty of Health Sciences Research Ethics Committee*

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

Research Ethics Committee
Room 4-60, Level 4, Tswelopele Building
University of Pretoria, Private Bag x323
Gezina 0031, South Africa
Tel +27 (0)12 356 3084
Email: deepeka.behari@up.ac.za
www.up.ac.za

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 18 March 2022 and Expires 18 March 2027.
- IORG #: IORG0001762 OMB No. 0990-0278 Approved for use through August 31, 2023.

Faculty of Health Sciences **Research Ethics Committee**

11 August 2022

Approval Certificate
New Application

Dear Mrs AS Ofosu

Ethics Reference No.: 357/2022
Title: Evaluating the Knowledge, Attitude and Practice of Ghanaian Healthcare Workers to inform strategies to prevent healthcare-associated spread of Respiratory infections

The **New Application** as supported by documents received between 2022-06-24 and 2022-08-10 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2022-08-10 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 2023-08-11.
- Please remember to use your protocol number (357/2022) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers
MBChB, MMed (Int), MPharmMed, PhD
Deputy Chairperson *of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria*

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

Research Ethics Committee
Room 4-60, Level 4, Tswelopele Building
University of Pretoria, Private Bag x323
Gezina 0031, South Africa
Tel +27 (0)12 356 3084
Email: deepeka.behari@up.ac.za
www.up.ac.za

APPENDIX B

INTRODUCTORY LETTER

File

In case of reply the number
and the date of this letter
should be quoted

My Ref: GHS/ASH/INTRO

Your Ref. No:

Email: rdhs.ar@ghsmail.org
Tel: 233 -0320-22089/23651
Fax: 233-0320-26219

GHANA HEALTH SERVICE
Your Health - Our Concern

GHANA HEALTH SERVICE
REGIONAL HEALTH DIRECTORATE
P. O. BOX 1908
KUMASI

25TH AUGUST, 2022.

THE MEDICAL DIR.
KUMASI SOUTH HOSPITAL
GHANA HEALTH SERVICE
ASHANTI

INTRODUCTORY LETTER

Approval has been given to Abena Serwaa Ofosu, a PhD student from Department of Nursing, University of Pretoria – South Africa to conduct a study titled **"Evaluating the Knowledge, Attitude and Practices of Ghanaian Healthcare Workers to inform Strategies to prevent the Healthcare-Associated spread of Respiratory Infections"** in your facility.

The aim of the study is to determine the healthcare workers' knowledge, attitude and practice toward COVID – 19 and to develop and refine strategies to prevent the healthcare-associated spread of the current and future pandemics.
A team of data collectors will be in your facility to interview healthcare professionals.

You are kindly requested to provide the team with all the needed support they may need to undertake this very important study.

Thank You

DR. EMMANUEL K. TINKORANG
REGIONAL DIRECTOR OF HEALTH SERVICES
ASHANTI REGION

Cc: Abena Serwaa Ofosu (Principal Investigator)
Tel: 0209154520

File,

In case of reply the number
and the date of this letter
should be quoted

My Ref: GHS/ASH/INTRO
Your Ref.

Email: rdhs.ar@ghsmail.org
Tel: 233 -0320-22089/23651
Fax: 233-0320-26219

GHANA HEALTH SERVICE
REGIONAL HEALTH DIRECTORATE
P. O. BOX 1908
KUMASI

25TH AUGUST, 2022.

THE MEDICAL SUPTS.
GHANA HEALTH SERVICE
ASHANTI

INTRODUCTORY LETTER

Approval has been given to Abena Serwaa Ofosu, a PhD student from Department of Nursing, University of Pretoria – South Africa to conduct a study titled **"Evaluating the Knowledge, Attitude and Practices of Ghanaian Healthcare Workers to inform Strategies to prevent the Healthcare-Associated spread of Respiratory Infections"** in your facility.

The aim of the study is to determine the healthcare workers' knowledge, attitude and practice toward COVID – 19 and to develop and refine strategies to prevent the healthcare-associated spread of the current and future pandemics.
A team of data collectors will be in your facility to interview healthcare professionals.

You are kindly requested to provide the team with all the needed support they may need to undertake this very important study.

Thank You

DR. EMMANUEL K. TINKORANG
REGIONAL DIRECTOR OF HEALTH SERVICES
ASHANTI REGION

Cc: Bekwai Municipal Hospital
Ejisu Government Hospital
Nkawie Government Hospital
Suntreso Government Hospital

APPENDIX C
STATISTICAL SUPPORT LETTER

Date: 24 / 04 /2022

LETTER OF CLEARANCE FROM THE BIOSTATISTICIAN

This letter is to confirm that the student with the Name ABENA SERWAA OFOSU

Studying at the University of Pretoria discussed the Project with the title EVALUATING THE KNOWLEDGE, ATTITUDE AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS with me.

I hereby confirm that I am aware of the project and also undertake to assist with the Statistical analysis of the data generated from the project.

The analytical tool that will be used will be SPSS 23, STATA AND EXCEL

to achieve the objective(s) of the study.

Name KENNEDY NARTEY Date 24/04/2022

Signature Knartey Tel: 0244777418

Department or Unit HEALTH INFORMATION (BIOSTATISTICS)

REGIONAL HEALTH INFOR. OFFICER
REGIONAL HEALTH DIRECTORATE
GHANA HEALTH SERVICE
KUMASI-ASHANTI

Official Stamp of Biostatistician

APPENDIX D

PARTICIPANT DEMOGRAPHIC INFORMATION FOR FOCUS GROUP INTERVIEW

DEMOGRAPHIC DETAILS

Please answer the following questions in the space provided, circle or tick the most appropriate options.

1. Age: ………………………………………………………………………………

2. Are you: (please tick as necessary) **[ ]** Male **[ ]** Female Other…………..

3. What is your professional background?

[ ] Nurse

[ ] Midwife

[ ] Medical officer

[ ] Allied Healthcare Professional

[ ] Maintenance Staff

4.Are you : (please tick as necessary) **[ ]** Healthcare staff **[ ]** Healthcare Manager/In charge

5. Experience in Healthcare (optional):

[ ] < 1 Year [ ] 1-2 Years

[ ] 2-5 Years [ ] 5-10 Years

[ ] > 10 Years

DISCUSSION QUESTIONS

The participants will discuss each strategy to refine it or delete it should it be indicated.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

APPENDIX E

PARTICIPANTS' INFORMATION AND INFORMED CONSENT DOCUMENT FOR A PARTICIPANT - ADMINISTERED QUESTIONNAIRE (PHASE 1)

STUDY TITLE: EVALUATING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT THE HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS.

Principal Investigator: ABENA SERWAA OFOSU

Supervisor: Prof. Neltjie C Van Wyk

Institution: University of Pretoria

Daytime telephone number: +233209154520.

Dear Prospective Research Participant

Dear Mr / Ms / Mrs/ Dr ……………………………………………………………………..

1) INTRODUCTION

You are invited to volunteer for a study. I am doing this research for Ph.D. degree purposes at the University of Pretoria. The information in this document is provided to help you to decide if you would like to participate. Before you agree to participate in this study, you should fully understand what is involved. If you have questions, not fully explained in this document, do not hesitate to ask the researcher. You should not agree to participate unless you are completely happy with the questions that will be asked.

2) THE NATURE AND PURPOSE OF THIS STUDY

The aim of this study is to determine the healthcare workers' knowledge, attitudes, and practices towards COVID-19, By doing so we wish to develop and refine strategies to prevent healthcare-associated spread of respiratory infections.

3) EXPLANATION OF PROCEDURES AND WHAT WILL BE EXPECTED FROM PARTICIPANTS

This study involves answering some questions regarding your knowledge, attitudes, and practices towards COVID-19.

We would like you to complete a questionnaire. It will take 30 minutes. We will collect the questionnaire from you before you leave the hospital. The researcher will keep the completed questionnaires in a safe place to ensure that only people working on the study will have access to it. Please do not write your name on the questionnaire. This will ensure that your responses are kept confidential (so nobody will know what you have answered).

The questionnaire comprises four parts:

Part 1: Socio-demographic information which involves answering some questions about your age, gender, marital status, religion, occupation, place of work, the highest level of education, length of work experience, and source of information on COVID-19.

Part 2: Health Questionnaire which involves answering some questions about your knowledge of COVID-19.

Part 3: Health Questionnaire involving answering some questions on your attitude towards COVID-19.

Part 4: The last part of the questionnaire involves answering questions on your practices of the COVID-19 preventive measures.

4) RISK AND DISCOMFORT INVOLVED

There is no foreseeable physical discomfort or risk involved. If there are questions too sensitive for you to answer, you do not need to answer them.

5) POSSIBLE BENEFITS OF THIS STUDY

This study may help to develop strategies to prevent the healthcare-associated spread of the current pandemic and future similar respiratory pandemics.

6) ETHICS APPROVAL

This Protocol was submitted to the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, Medical Campus, Tswelopele Building, Level 4-59, Telephone numbers

+27712 356 3084 / +27712 356 3085 and written approval have been granted by that committee. The study has been structured according to the Declaration of Helsinki (last update: October 2013), which approaches the recommendations guiding doctors in biomedical research involving humans. A copy of the Declaration may be obtained from the investigator should you wish to review it.

7) INFORMATION

If you have any questions concerning this study, you may contact ABENA SERWAA OFOSU (MRS) at +233209154520. Alternatively, you may contact her supervisor Prof. Neltjie Van Wyk at cell +27782 776 1649.

8) CONFIDENTIALITY

All records from this study will be regarded as confidential. All results will be published or presented in such a way that it is not possible to identify the participants.

9) CONSENT TO PARTICIPATE IN THIS STUDY

- I confirm that the person requesting my consent to participate in this study has told me about the nature and process, any risks or discomforts, and the benefits of the study.
- I have also received, read and understood the above written information about the study.
- I have had adequate time to ask questions and I have no objections to participate in this study.
- I am aware that the information obtained in the study, including personal details, will be anonymously processed and presented in the reporting of results.
- I understand that I will not be penalised in any way should I wish to discontinue the study and my withdrawal will not affect my employment or student status.
- I am participating willingly.

NOTE: If you participate in Phase 1, the researcher may call you for a follow-up in Phase 2 of the study in four weeks.

APPENDIX F

PARTICIPANTS' INFORMATION AND INFORMED CONSENT DOCUMENT FOR A FOCUS GROUP INTERVIEW RESEARCH (PHASE 2)

Study title: EVALUATING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT THE HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS

Principal Investigator: Abena Serwaa Ofosu

Supervisor: Prof**.** Neltjie C Van Wyk

Institution: University of Pretoria

Dear Prospective Participant

Dear Mr / Mrs...............................

1) INTRODUCTION

You are invited to volunteer for research. I am doing this research for PhD degree purposes at the University of Pretoria. This document gives you information in this document is provided to help you decide if you would like to participate. Before you agree to participate in this study you should fully understand what is involved. If you have any questions, not fully explained in this document, do not hesitate to ask the investigator. You should not agree to participate unless you are completely happy about what we will be discussing during the focus group discussion.

2) THE NATURE AND PURPOSE OF THIS STUDY

The aim of this study is to determine the healthcare workers' knowledge, attitudes, and practices towards COVID-19, By doing so we wish to develop and refine strategies to prevent healthcare-associated spread of current pandemic and future similar pandemics. Part of the study will be a focus group discussion. A focus group is where a few people – usually eight or 10, meet with the researcher to discuss a specific topic. The discussion will be arranged at a time convenient for you.

3) EXPLANATION OF PROCEDURES AND WHAT WILL BE EXPECTED FROM PARTICIPANTS

If you agree to participate, you will be asked to participate in a focus group discussion which will take about 45-60 minutes. You and the other participants will be provided a form to provide your demographic information. The draft strategies will be provided to you before the discussion commence. You will evaluate every draft strategy, rephrase it, if necessary, remove it if it is not applicable, and appreciate it, when it is appropriate.

We will not ask any questions about your personal experience. The Co-facilitator will manage logistic arrangements, write field notes and with your permission, the discussions will be recorded on a recording device to ensure that no information is missed.

4) RISKS AND DISCOMFORTS INVOLVED

We do not think that participating in the study will cause any physical or emotional discomfort or risk.

If questions feel too personal or make you uncomfortable, you do not have to answer them.

5) POSSIBLE BENEFITS OF THIS STUDY

You will not benefit directly by being part of this study. Your participation is important for us to better understand and develop strategies to prevent the healthcare-associated spread of the current respiratory pandemic and future similar pandemics. The information you present may help the researcher improve healthcare in Ghana during current and future similar pandemics.

6) COMPENSATION

You will not be paid to participate in the study. There are no costs involved for you to be part of the study, however, the cost of transportation from your facility to the venue will be reimbursed. Maximum amount of 100 Ghana cedis will be provided to you.

7) VOLUNTARY PARTICIPATION

The decision to participate in the study is yours and yours alone. You do not have to participate if you do not want to. You can also stop at any time during the interview without giving a reason. If you refuse to participate in the study, this will not affect you in any way.

8) ETHICAL APPROVAL

This study was submitted to the Research Ethics Committee of the Faculty of Health Sciences at the University of Pretoria, Medical Campus, Tswelopele Building, Level 4-59, telephone numbers

+27712 356 3084 / +22712 356 3085 and written approval has been provided by that committee. The study will follow the Declaration of Helsinki (last update: October 2013), which guides doctors on how to do research in people. The researcher can give you a copy of the Declaration if you wish to read it.

9) INFORMATION ON WHO TO CONTACT

If you have any questions concerning this study, you may contact: ABENA SERWAA OFOSU (MRS)

10) CONFIDENTIALITY

We will not record your name anywhere and no one will be able to connect you to the responses you give. Your responses will be linked to a fictitious code number, or a pseudonym (another name) and we will refer to you in this way in the data, any publication, report, or other research output.

All records from this study will be regarded as confidential. Results will be published in medical journals or presented at conferences in such a way that it will not be possible for people to know that you were part of the study.

The records from your participation may be reviewed by people responsible for ensuring that research is conducted properly, including members of the Research Ethics Committee. All these people are required to keep your identity confidential. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to view the records.

10) CONSENT TO PARTICIPATE IN THIS STUDY

- I confirm that the person requesting my consent to participate in this study has told me about the nature and process, any risks or discomforts, and the benefits of the study.
- I have also received, read, and understood the above written information about the study.

- I have had adequate time to ask questions and I have no objections to participate in this study.
- I am aware that the information obtained in the study, including personal details, will be anonymously processed and presented in the reporting of results.
- I understand that I will not be penalised in any way should I wish to discontinue with the study and my withdrawal will not affect my treatment and care.
- I am participating willingly.
- I have received a signed copy of this informed consent agreement.

______________________________	______________________
Participant's name (Please print)	Date
______________________________	______________________
Participant's signature	Date
______________________________	______________________
Researcher's name	Date
______________________________	______________________
Researcher's signature	Date

I understand that the focus group discussion will be audiotaped. I give consent that it may be audio-recorded.

YES

NO

Name of the person who witnessed

the informed consent

Date

Signature of the witness

Date

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

APPENDIX G

DATA COLLECTION INSTRUMENT

QUESTIONNAIRE

University of Pretoria

School of Health Care Sciences

Study Title: EVALUATING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT THE HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS.

This is a questionnaire to help the researcher investigate Knowledge, attitude, and practices of COVID-19 among healthcare workers in the Ashanti Region.

PART A: Socio-Demographic Information

Please tick (✓) or write as appropriate.

1. Age…………

2. **Gender**

[ ] Male

[ ] Female

5. Occupation/Specialisation

[ ] Doctor

[ ] Nurse

[ ] Midwife

[ ] Allied health professional

[ ] Maintenance staff

Other……………

3. **Marital status**

[ ] Single

[ ] Married

[ ] Separated

[ ]Widowed

4. Place of work…………………

6. Duration of experience

[ ] less than 2years

[ ] 2-5years

[ ] greater than 5years

7.**Religion**

[ ] Christianity

[ ] Islam

[ ] Traditional religion

Others………………………

8.Source of information on COVID-19

[ ] Social media

[ ] News media

[ ] Websites of hospitals/GHS

[ ] Friends/relatives

[ ] International health organization e.g. WHO

9.Highest level of education

[ ] PhD

[ ] Masters

[ ] Bachelors

[ ] Diploma

[ ] Certificate

PART B: Healthcare workers' Knowledge on COVID -19

For the statement below, please indicate whether you agree (A) strongly agree (SA) Neutral (N) disagree (D) strongly disagree (SD).

NO	Statement.	SA	A	N	D	SD
10.	COVID-19 is caused by a virus.					
11.	COVID-19 is new and has never been recorded before 2019					
12.	The incubation period of the disease may be up to 14 days.					

13.	The main symptoms of COVID-19 are cough, fever, headache, tiredness, and difficulty in breathing.					
14.	A person may have COVID-19 yet display no symptoms.					
15.	COVID-19 is transmitted through respiratory droplets and contacted with infected persons.					
16.	COVID-19 transmission by animal product is unknown.					
17.	COVID-19 is transmitted mainly through the air.					
18.	The disease transmission from asymptomatic persons is possible.					
19.	Pets may be infected, and transmission from pets is unknown.					
20	Currently, the main method of diagnosis is rRT-PCR test					
21.	Currently, the main method of diagnosis is the antibody kit.					

22.	COVID -19 can be treated.					
23.	Suspected persons with COVID-19 must go into self-isolation for 14 days.					
24.	Confirmed cases of COVID-19 are often quarantined.					
25.	Antibiotics are the first line of treatment.					
26.	Persons with fundamental condition disease are at increased risk of severe cases and death.					
27.	COVID-19 can be prevented by regular wearing of face mask.					
28.	COVID-19 can be prevented by frequent washing of hands with soap and water.					
29.	Use of alcohol –based hand sanitisers prevent COVID 19					
30.	70% alcohol kills the virus.					
31.	Chlorhexidine kills the virus.					

32.	keeping a distance of at least 1 metre (3 feet) prevents one from contracting the disease.					
33.	Maintaining even a greater distance between yourself and others when indoors can prevent contracting COVID-19.					
34.	Currently, there is a vaccine for COVID-19					

PART C: Healthcare Workers' Attitude towards COVID-19

For the statement below, please indicate whether you agree (A) strongly agree (SA) Neutral (N) disagree (D) strongly disagree (SD).

NO.	Statements	SA	A	N	D	SD
35.	I fear working in a hospital when COVID-19 patients are admitted					
36.	I fear caring for COVID-19 patients					
37.	I believe that I may transmit the disease to my family					

38.	Healthcare workers become infected at a high rate, even with adequate protection					
39.	I must report to my facility if I become infected with COVID-19					
40.	I must stay home and self-isolate when presented with minor symptoms like cough, headache, mild fever until I recover					
41.	I should be responsible on ensuring that people around me follow good respiratory hygiene, use of face mask, proper disposal of used tissue and social distancing					
42.	Health education programmes are effective for better control of COVID-19					
43.	COVID-19 Pandemic will be successfully controlled by the current guidelines and vaccine					

PART 4: Healthcare Workers’ Practices Towards COVID-19

For the statement below, please indicate whether **YES** or **NO** or **lack of equipment /facility**

NO.	Statements	YES	NO	Lack of equipment/facility
44.	Do you have access to the PPE that protect you for the appropriate setting and context?			
45.	Have you been trained on donning and discarding of PPEs?			
46.	Do you used PPE when you visit a susceptible patient?			
47.	Do you wear a surgical face mask when doing the usual physical examination?			
48.	Do you wear the N95 face mask when doing aerosol- generating procedures			
49.	Do you test the N95 mask before using it?			
50.				

	Do you dispose your gloves and aprons after a single used on each patient contact?			
51.	Do you use your fluid –repellent surgical mask and eye protection for a session of work or other than a single patient?			
52.	Do you wear your gowns or coveralls for a session of work in higher risk areas?			
53.	Do you disinfect linen/beddings used by patients infected with COVID-19 before sending them to the laundry?			
54.	Do you wash your hands with soap and running water after physical encounter with patients?			
55.	Do you wash your hands for at least 20 seconds?			
56.	Do you use a paper towel or towel to turn off the faucet after washing your hands?			
57.				

	Do you regularly clean your hands with alcohol-based sanitiser?			
58.	Are you able to maintain at least 1 metre (3feet) distance between yourself and others?			
59.	Are you able to isolate susceptible patients as soon as they arrived?			
60.	Do you recommend home isolation to anyone who encounter a patient infected with COVID-19?			

APPENDIX H

FOCUS GROUP INTERVIEW FIELD NOTES

STRATEGY 1: Ensuring triage, early recognition, and source control.	
Actions.	
Be trained to recognise the signs and symptoms of respiratory infections.	
Display information at the entrance of the healthcare service directing patients with signs and symptoms of ARIs to report for screening.	
Be encouraged to be alert to any respiratory infection outbreak in all patients visiting the service.	P1 Add ‘The health promotion officers should inform all staff when there is an outbreak of respiratory infections.
Pre-triage all patients with cough and fever and provide a surgical mask.	
Wear appropriate PPE and perform regular hand hygiene during the screening of patients.	P6 Change action to ‘Wear appropriate personal protective equipment and perform regular hand hygiene before and after the screening of patients.’
Use standardised and validated triage devices to identify individuals needing immediate care and those who can safely wait during triaging of other patients.	P1 Add ‘for respiratory infections’ at the end of devices. P2 Same; P3 Same.
Encourage all patients with acute respiratory symptoms to wear masks in the waiting area of the healthcare service.	P3 Add another action. Ensure social distancing in the waiting area.
Ensure early testing for respiratory infections.	

STRATEGY 2: Apply standard and transmission-based precautions.	
Actions.	
Standard-based precaution.	
When ensuring hand hygiene, healthcare workers should:	
Wash hands before and after touching a patient, before and after a procedure or body fluid exposure, and after touching a patient's surroundings.	P3 Add 'with soap under running water' at the end of hands. P2 Same
Clean hands with alcohol-based sanitiser containing 60-80% alcohol or with soap, water, and disposable towels.	P 10 Add as additional actions Hand washing facilities should be maintained in good condition and supplies of paper towels and soap should be topped up regularly to encourage staff/clients to use them. P10 Posters displaying hand washing techniques and promoting hand washing should be positioned on the wall adjacent to washing facilities; to promote and remind people of the techniques, stages, and processes of hand washing.
Keep fingernails short and ensure healthy hand skin.	
When ensuring the appropriate use of PPE, healthcare workers should:	

Perform a risk assessment before encountering patients to determine whether using PPE is required.	
Be trained on donning and discarding PPE and the scientific basis for the recommendations about protective practices.	
Put on a full set of PPE (N95 Mask, gown, gloves, and eye protection), when managing patients with respiratory infections in high-risk areas.	P3 Add ‘boots P2 Add ‘hair cap’.
Have prompt access to the recommended PPE.	
Perform a fit test and seal check when using the N95 mask.	
Ensure proper respirator fit by shaving their beard or thick facial hair.	
Remove PPE before leaving the area.	P6 Change action ‘Remove personal protective equipment at a safe area before leaving’. P7 Add as additional action ‘Use disposable personal protective equipment only once and dispose of them appropriately’. P10 Same
Perform hand hygiene immediately after removing PPE.	
When ensuring respiratory hygiene practices:	

Post signs at entrances with instructions to staff, patients, and accompanying individuals with symptoms of respiratory infections to:	
Wear masks when necessary.	
Cough and/or sneeze in a bent elbow or into a disposable tissue and dispose of it immediately in a bin.	
Perform hand hygiene afterwards	
Provide tissue and no-touch bins for disposal of tissues.	
Provide masks to coughing patients and other persons with respiratory infections.	P1 Add as additional action 'Ensure Social distancing' when having respiratory infections;P3 Same.
When ensuring a clean environment, healthcare workers should:	
Ensure the cleaning of patients' environment, surfaces, medical devices used, and other equipment with water and recommended detergents.	P5 Add 'and disinfectants' at the end of the detergents. P10 Add as additional actions When leaving the ward health workers should ensure that their cell phones and spectacles are cleaned. Health workers should aim for more frequent detergent cleaning, followed by disinfection with appropriate concentrations of detergents to reduce the chance of being infected and spreading from contaminates. P8 Ensure high periodic dusting in all healthcare facilities.

Ensure that the laundry and the management of linen are completed by safe routine procedures.	
Ensure that medical waste is managed by recommended measures.	P9 Remove 'by' and Add 'in accordance with'.
Transmission-based precautions.	
When implementing transmission-based precautions, healthcare workers should:	
Wear surgical masks, eye protection, gowns/aprons, and gloves during patient care.	P1 Use N95 and above for confirmed air born disease transmission and surgical mask for suspected cases.
Ensure appropriate donning and discarding of PPE.	
Use single rooms for patients with respiratory diseases.	P3 Change action 'Isolation of patients with respiratory disease;P1 Same P6;P7 Same;P8 Same.
Refrain from touching their eyes, noses, or mouths with potentially contaminated gloved or bare hands	
Frequently clean and disinfect surfaces with which patients are in contact.	
Perform aerosol-generating procedures in an adequately ventilated room.	

STRATEGY 3: Education and training of healthcare workers.	

Actions.	
Healthcare workers/healthcare managers/stakeholders should:	
Receive adequate education on respiratory infections, focusing on characteristics of the disease, level of risk in the healthcare service, and the healthcare service plan to respond to the infection.	P7 Add 'transmission' at the end of the disease.
Be trained on the correct donning and discarding of personal protection equipment.	
Have training in standard precautions, in particular hand hygiene, respiratory hygiene, and cough etiquette, along with transmission-based precautions (contact, droplet, and airborne), including the appropriate use of PPE for each situation.	
Receive refresher courses on standard and transmission-based precautions if they have already been trained.	CF Add as an additional action 'Ensure periodic stimulation exercise after receiving training';P7 Same.
Be provided with brochures, posters, and banners with information on preventing respiratory infections.	
Should include basic IPC in all health pre-curriculum training for medical staff.	

STRATEGY 4: Engineering controls.	
Actions.	

When ensuring engineering controls, healthcare workers/healthcare managers should:	
Maintain a distance of at least one metre between patients with respiratory infections and other individuals.	
Ensure healthcare facilities are designed, furnished, and supplied with materials and finishes simple to clean.	P 10 Replace ‘simple’ with ‘easy’
Ensure isolation wards equipped with negative-pressure AIIRs are built to accommodate patients with high-risk respiratory infections.	
Ensure isolation rooms are situated in an area separated from other patient care areas.	
Ensure that triage and waiting areas are designed and used in a way that transmission of respiratory diseases is prevented.	
Ensure that rooms are adequately ventilated when performing aerosol-generating medical procedures.	
Maintain ventilation in the healthcare setting, considering comfort and weather. The goal is to achieve reasonable air exchange with gentle air movement.	

Strong airflow into the room from outside readily felt and causes discomfort is not required and may contribute to airflow from the room.	
Ensure rooms are adequate to accommodate wheelchair users and mobile medical equipment and to prevent overcrowding.	P2 Add ‘spacious’ at the end of ‘are’; P1 Same
Improve indoor ventilation by opening windows or doors.	
Reduce the duration of mechanical ventilation for patients on admission and a new ventilator circuit should also be provided to each patient.	
Ensure social distancing in an indoor public place.	

STRATEGY 5: Active surveillance programme for staff and patients with ARIs.	

Actions.	
Screening of all healthcare workers and patients and visitors entering the healthcare facility for signs and symptoms of respiratory illnesses.	
Healthcare workers should ensure that reporting systems for ARIs among staff and patients are in place in the healthcare service.	
Healthcare workers who develop respiratory infections should report their condition according to facility protocol.	
There should be early identification of staff absence/s owing to a respiratory infection outbreak.	
Anyone who screens positive on the ARIs case finding/surveillance protocol should be instructed to implement appropriate precautions and later referred for medical assessment.	
Patients/visitors and staff in the healthcare setting must be monitored for signs of acute respiratory infection using the recommended device.	
There should be effective working relationships between the healthcare setting and the public health unit. Clear lines of communication are maintained. The public health unit is contacted for information and advice as required and the obligations to report any respiratory infection outbreak.	P4 Replace 'Healthcare setting' with 'curative unit'; CF same

STRATEGY 6: Restriction of visitors and caregivers.	
Actions.	
Healthcare workers should ensure that visitors and family members visiting patients with respiratory infections are limited per facility protocol.	
All healthcare settings must have signage posted at all entrances instructing all clients/patients/residents, visitors, and volunteers about any restrictions implemented.	
Visitors must practice hand hygiene, be instructed in, and adhere to appropriate precautions when visiting, and not visit if they have any acute respiratory illness/ symptoms.	
Health care settings where exposure, with or without transmission of respiratory infection, has occurred should restrict the number of available entrances into the facility.	
Individuals wanting to visit loved ones should use designated entrances in healthcare facilities.	
All visitors should continue to wear a well-fitting mask when entering the healthcare facility.	P7 Add 'and relatives' at the end of visitors
Healthcare workers should ensure that visitors and family members visiting patients with	

respiratory infections are limited per facility protocol.	

STRATEGY 7: Vaccination of Healthcare workers.	
Actions.	
Mandatory vaccination for healthcare workers for vaccine-preventable respiratory diseases according to national recommendations.	
Ensure healthcare workers know that they should be vaccinated, including boosters.	
Encourage a high level of vaccine intake by health staff by providing appropriate support to staff with questions about the benefits and risks of vaccination.	
Provision of education on the benefits and risks of vaccination to healthcare workers.	
Ensure healthcare workers have easy access to the vaccination sites.	P4 Replace ‘sites with ‘centers’
Ensure promotional activities, such as using promotional material, including advertising posters hung up in the wards, banners in the hospital, an Internet page, and a campaign presentation event to increase vaccination coverage for healthcare staff.	P8 Add as additional action ‘Ensure health care staff who take vaccinations are motivated’**;**P9 Same;P7 Same;P6 Same
Ensure regular review of the uptake of vaccination by healthcare staff regarding respiratory infections.	

STRATEGY 8: Promoting healthy behaviours to strengthen the immune system	
Actions	
When ensuring regular exercise:	
Healthcare staff, patients, and the public should be advised to engage in moderate exercises, considering their health condition.	
Healthcare workers should educate patients and the public on the risks and benefits of regular moderate-vigorous exercises.	
Patients admitted to the ward should be engaged in moderate/passive exercise, depending on their health condition.	
When ensuring adequate nutrition and hydration:	
Advise patients, healthcare workers, and the public to increase their fluid intake.	P2 Replace ‘Advise’ with ‘Encourage’
Provide education on the importance of ensuring adequate hydration.	
Advise healthcare staff and the public to keep a record of their water intake using the recommended applications on their phones.	P2 Replace ‘Advise’ with ‘Encourage’
Encourage healthcare workers, patients, and the public to take a diet rich in vitamins and minerals	

Provide dietary education for patients and relatives at the healthcare facility.	
Provide dietary supplements to the vulnerable (pregnant women, children) in the society	P2 Add 'the Aged' P8 Add 'as well as Healthcare workers' at the end of the society.
When ensuring smoking cessation:	
Provide health education on the effect of smoking on respiratory infections	
Place banners and posters at the entrance of the healthcare facility showing the effects of smoking.	
Provide support for healthcare staff and patients who smoke to quit through counselling programmes	
When ensuring stress reduction:	
Provide education on various stress management techniques to healthcare staff, patients, and the public.	
Healthcare managers should implement measures to ensure adequate staff per shift.	
Encourage healthcare staff to enjoy their annual vacation according to facility protocol.	

STRATEGY 9: Adequate supply of PPE	
Actions	

Provide sufficient and appropriate PPE to healthcare workers, patients, and visitors in the healthcare service.	P2 Add 'The healthcare setting should' at the beginning of the sentence**.**
The healthcare setting should ensure that the recommended PPE is accessible and available, and that staff members have received training on its use.	P10 Rephrase it 'The healthcare setting should ensure that the recommended PPE are available and accessible, and that staff members have received training on its usage and disposal'.
Ensure patients, caregivers, and visitors in the healthcare facility have access to recommended PPE.	P7 Add 'regular' in front of the 'access'
Adequate resources should be devoted to infection prevention and control programmes in all healthcare settings, and adequate inventories of PPE should be maintained.	

STRATEGY 10: Monitoring and evaluation and investing in research	
Actions	
Healthcare Managers/stakeholders should:	
Conduct adherence monitoring for healthcare workers on recommended IPC measures, using the recommended devices, such as, hand hygiene audit	
Ensure regular assessment of the effectiveness of the IPAC programme and its impact on practices in the healthcare setting	

Conduct healthcare facility risk assessment and communicate results/feedback to each unit in the healthcare facility.	
Be reminded of the need to be able to demonstrate training, and is, therefore, encourage to document the workers trained, the dates training was conducted, and the information and materials included during training.	P4 Change action 'Be reminded of the need to be able to demonstrate training, and the importance to document the workers who are trained, the dates training was conducted, and the information and materials covered during training'**.**
Provide appropriate support and supervision for staff during an outbreak of a respiratory infection	
Be supported financially when conducting research on respiratory disease and its management in the healthcare setting.	

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

APPENDIX I

LANGUAGE EDITING CERTIFICATE

Nr: 202826

ACADEMIC AND PROFESSIONAL EDITING SERVICES (APES)

Tel nr: USA: +1 (773) 217-4568/ NZ: +64 22 359 2202 SA +27 81 534 3590/
www.apespro.com; Facebook: www.facebook.com/apespro

LANGUAGE EDITING CERTIFICATE

Report title:	EVALUATING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF GHANAIAN HEALTHCARE WORKERS TO INFORM STRATEGIES TO PREVENT HEALTHCARE-ASSOCIATED SPREAD OF RESPIRATORY INFECTIONS
Author/s:	Abena Serwaa Ofosu
Institution:	University of Pretoria
Date Issued:	22 November 2023

This document certifies that the manuscript listed above was edited for proper English language, grammar, punctuation, spelling, and overall style. Neither the research content nor the author's intentions were altered in any way during the editing process. Documents receiving this certification should be English ready for publication; however, the author has the ability and choice to accept or reject our suggestions and changes.

Disclaimer: 1. We do not accept responsibility for revisions and recommendations that were rejected or ignored. 2. We do not take responsibility for plagiarism.

If you have any questions or concerns about this document or certification, kindly contact: Info@apespro.com

APES is committed to providing high-quality services for professionals and researchers. To find out more about APES, visit www.apespro.com.

Warm regards

Elizabeth Marx

SAFREA regional committee member (2020 & 2023); Represented South Africa in the EFA International Editors' Conference – Chicago: August 2019 https://www.the-efa.org/efas-2019-conference-announcement/