A PHENOMENOLOGICAL EXPLORATION OF THE MENTAL HEALTH AND WELL-BEING EXPERIENCES OF RADIOLOGY STAFF IN THE ETHEKWINI DISTRICT OF SOUTH AFRICA DURING A HEALTH CRISIS

Shillah Nyaradzo Hundah (21649783)

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Supervisor: Prof M.N. Sibiya

Co-supervisor: Dr T.E. Khoza

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Declaration

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Durban University of Technology or to any other institution for assessment or for any other purpose.

2 July 2025

Shillah Nyaradzo Hundah
MHSc: Radiography

Date

Approved for final submission

2 July 2025

Prof M.N. Sibiya
D Tech: Nursing

Date

2 July 2025

Dr T.E. Khoza
PhD: Health Sciences

Date

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Abstract

Background

Globally, one in 10 health workers contract nosocomial infections while on duty. In South Africa, frontline healthcare workers have a record of six times more hospital admissions for the management of extensively drug-resistant tuberculosis (XDR TB) compared to non-healthcare workers. As frontline health workers, radiology staff are at risk of nosocomial infections which are exacerbated during health crises such as the Coronavirus disease 2019 (COVID-19) pandemic. To date, approximately 10% of the COVID-19 cases globally are among healthcare workers. Health crises have also been associated with aggravated occupational stress levels, which negatively impact work competencies. However, no known study has examined the mental health and well-being experiences of the eThekwini district frontline radiology staff during the COVID-19 pandemic.

Aim

The aim of this study was to explore the mental health and well-being experiences of radiology staff in the eThekwini district of South Africa during a health crisis.

Methods

A social constructivist position was implemented with the qualitative, Interpretative Phenomenological Analysis (IPA) methodology. Data were collected in two independent phases in a multi-method approach, through the use of semi-structured one-on-one interviews in the first phase and focus groups in the second phase. Non-probability sampling was implemented through use of maximum variation sampling. The sample comprised 24 staff working in private and public radiology departments within the eThekwini district of KwaZulu-Natal (KZN) province in South Africa. Phase 1 of data collection involved 13 participants who had one-to-one semi-structured interviews while Phase 2 constituted five and six participants for the two focus groups respectively. Audio recordings of the interviews were transcribed into text data, coded and categorised into themes

through the use of the IPA. The Delphi method was employed to validate the resultant mental health support framework.

Findings

A detailed insight into the mental health and well-being experiences of frontline radiology staff during the COVID-19 pandemic was established. Resultantly, seven themes were developed, namely: duties and roles during the COVID-19 pandemic, personal and work-related challenges, emotional and psychological experiences when carrying out duties, impact on emotional well-being, impact of resultant mental health status on professional competencies, coping strategies, and interventions for mental health effects. The study evidenced that frontline radiology staff within the eThekwini district experienced mental health challenges such as stress, fear and anxiety.

Clinical implications

The developed mental health support framework could be adopted by radiology departments to enhance staff mental wellness and coping abilities during health crises. Resultantly, standards of radiological images, diagnosis and patient care will be maintained.

Key words: Health crisis, COVID-19, radiology, mental health, coping

Dedication

I would like to dedicate this study to my family for their unwavering support during all the ups and downs of my studies. My children, Fadeke Aderibigbe and Luke Aderibigbe, your smiles and love brighten all my days. My aunt, Ellen Garikai, thank you for believing in me and giving me the opportunity to pursue my dreams. To my late mother, Angeline Hundah and late sister, Gamuchirai Karen Hundah, I miss you dearly.

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Glossary of terms

Private Channel and Accompanying: A dedicated pathway where patients' medical history was taken, and nasal samples were collected during the COVID-19 pandemic (Yu *et al.* 2020).

Competence: A combination of knowledge, skills, attributes and behaviours resulting in effective performance of a task (Maaleki 2018).

Contact tracing: The process of identifying, assessing, and monitoring individuals exposed to someone infected with the COVID-19 virus (World Health Organisation 2021).

Coping: Intentional thoughts and behaviours that are adapted to address internal and external stressful situations (Folkman and Moskowitz 2004).

Decentralise: To distribute the control of an organisation or central government from a single place to several smaller ones around the country (Cambridge Dictionary 2020; Oxford Learner's Dictionaries 2025).

Evidence-based: Concept developed from or informed by provable evidence such as research (Great Schools Partnership 2014; Cambridge Advanced Learners' Dictionary and Thesaurus 2023).

Frontline radiology staff: Healthcare workers providing radiology services to patients through direct and close contact (Patel, Nadel and West 2014). This includes radiographers, radiologists and radiology nurses.

Health crises: Challenging, complex and suddenly occurring health situations affecting the public population in one or more geographical locations (Chinengundu, Chakamba and Hondonga 2022).

Lived experience: An individual's first-hand encounter and interaction with a phenomenon (Given 2008; Chandler and Munday 2011).

Lockdown: a state of isolation, containment, or restricted access, normally implemented as a public health or security measure (Oxford English Dictionary 2023).

Mental health: 'A basic human right which refers to the state of mental well-being that enables people to cope with the stresses of life, realise their abilities, learn well and work well, and contribute to their community.' (World Health Organization 2022).

PhD holder: An individual who has earned a doctor of philosophy qualification, the highest college or university degree (Cambridge Dictionary 2023).

Radiographer: Allied health professional responsible for carrying out medical imaging examinations that assist in diagnosis and management of diseases and injuries (Heath direct 2023).

Radiologist: Specialist medical doctor responsible for interpreting medical images, medical imaging examinations and carrying out interventional medical imaging tests (Health direct 2023).

Radiology department: Multidisciplinary specialist medical department that utilises diverse imaging technologies to diagnose diseases and guide treatment (National Library of Medicine 2023).

Radiology nurse: Nursing professional who provides medical care and comfort to patients before, during and after medical imaging procedures (Hamlin 2022).

Social distance: A public health measure designed to limit close contact and mitigate the spread of infectious diseases by maintaining a physical distance between individuals (Centers for Disease Control and Prevention 2020).

Support: Assistance or comfort in various forms that seeks to help an individual cope with biological, psychological and social stressors (American Psychological Association 2023).

Visor: A personal protective equipment device worn by healthcare workers for protection of the facial area and mucous membranes from splashes, sprays, and spatter of body fluids. It is also known as a face shield or face mask (Roberge 2016).

List of abbreviations and acronyms

Acronym	Full word/sentence
AD	Assistant Director
AE or A&E	Accident and Emergency
AIS	American Institute of Stress
APA	American Psychological Association
ARDS	Acute Respiratory Distress Syndrome
AT	Attribution Theory
BMD	Bone Mineral Density
BSU	Bed Side Unit
CDC	Centres for Disease Control and Prevention
CEO	Chief Executive Officer
CINAHL	Cumulated Index to Nursing and Allied Health Literature
CM	Contrast media
COVID-19	Coronavirus disease 2019
CPD	Continuing Professional Development
CR	Computed Radiography
CRV	Community respiratory virus
CT	Computed Tomography
CTPA	Computed Tomography Pulmonary Angiograms
CTPE	Computed Tomography Pulmonary Embolus
CUPA	Cambridge University Press and Assessment
CVA	Cerebrovascular accidents
CVP	Central Venous Pressure
CXR	Chest x-ray
DPSA	Department of Public Service and Administration
DUT	Durban University of Technology
DVT	Deep vein thrombosis

EAP	Employee Assistance Programme
EBSCO	Elton B. Stephens Company
EET	Employment Equity Target
EMBASE	Excerpta Medica Database
ESR	European Society of Radiology
ESS	Emotional State Scale
FGD	Focus group discussion
GGO	Ground-Glass Opacity
HAI	Hospital-acquired infections
HBM	Health Belief Model
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human Immunodeficiency Virus
HPA	Hypothalamic-pituitary-adrenocortical
HPCSA	Health Professions Council of South Africa
HRCT	High-Resolution Computed Tomography
ICRP	International Commission on Radiological Protection
ICU	Intensive Care Unit
IPA	Interpretative Phenomenological Analysis
IPC	Infection Prevention and Control
IR	Interventional radiographers
IREC	Institutional Research Ethics Committee
IR(ME)R	Ionising Radiation (Medical Exposure) Regulations
IV	Intravenous
KZN	KwaZulu-Natal
kg	kilogram
LTH	Leeds Teaching Hospitals
MEDLINE	Medical Literature Analysis and Retrieval System Online
MERS-CoV	Middle East Respiratory Syndrome Coronavirus

MHF	Mental Health Foundation
MRI	Magnetic Resonance Imaging
NAAT	Nucleic Acid Amplification Test
NCS	National Careers Service
NDoH	National Department of Health
NGT	Nasogastric tube
NHR	National Health Research
NICD	National Institute of Communicable Diseases
NIOSH	National Institute for Occupational Safety and Health
NRF	National Research Foundation
N95	Non-oil 95 percent efficiency
OECD	Organisation for Economic Co-operation and Development
OHSA	Occupational Health and Safety Act
OSD	Occupation Specific Dispensations
PACS	Picture Archiving and Communication System
PCR	Polymerase chain reaction
PE	Pulmonary embolism
pH	Potential of Hydrogen
PhD	Doctor of Philosophy
PICC	Peripherally inserted central catheters
PIO	Population, Issue and Outcome
PPE	Personal Protective Equipment
PsycInfo	Psychological Information Database
PTSD	Post-traumatic stress disorder
PUI	Patients under investigation
RANZCR	Royal Australian and New Zealand College of Radiologists
RCR	Royal College of Radiologists
RCT	Randomised control trials
RIS	Radiology Information System

RSSA	Radiological Society of South Africa
RT-PCR	Real-Time Reverse Transcriptase–Polymerase Chain Reaction
SADHD: RC	South African Department of Health Directorate: Radiation Control
SARS	Severe Acute Respiratory Syndrome Coronavirus
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SANC	South African Nursing Council
SCoR	Society and College of Radiographers
TMSC	Transactional Model of Stress and Coping
UK	United Kingdom
USA	United States of America
USC	University of Southern California
US FDA	United States Food and Drug Administration
WELCOA	Wellness Council of America
WHO	World Health Organization
WMA	World Medical Association
XDR TB	Extensively drug-resistant tuberculosis

CHAPTER 1: OVERVIEW OF THE STUDY

1.1 INTRODUCTION

Health crises often exacerbate pre-existing challenges and introduce new pressures, including significant impacts on mental health and well-being (De Brier *et al.* 2020; Giorgi *et al.* 2020; Salazar de Pablo *et al*. 2020). Understanding these dynamics is essential, as baseline data can help inform reflection and preparation for future health emergencies, as well as support the well-being of staff (Chinene 2023). Such understanding highlights the need for phenomenological enquiries that capture the lived experiences of those affected.

Despite the importance of this area of study, no research has specifically addressed the mental health and well-being of frontline radiology staff in the eThekwini district of South Africa during a health crisis. South Africa's healthcare system is characterised by variations across public and private institutions (Modisakeng *et al.* 2020). Provincial departments of health oversee service delivery and financial management for their respective provinces (Wishnia and Goudge, 2020). As a result, the challenges faced by frontline radiology staff during a health crisis may differ significantly depending on geographical and economic contexts. The unique experiences of these professionals highlight the necessity of conducting a phenomenological inquiry to gain deeper insights into their mental health and well-being.

The foundation of the present study was shaped by the researcher's personal experiences as a radiographer during the Coronavirus Disease 2019 (COVID-19) pandemic, as well as prior research. The global focus on the mental health impacts of health crises, particularly during the COVID-19 pandemic, prompted an exploration of how such events affect frontline radiology staff. A review of existing literature revealed the aforementioned substantial gap in understanding the specific mental health and well-being experiences of

frontline radiology staff, particularly in the eThekwini district of South Africa. Addressing the identified gap provided the impetus for the current study and informed the selection of a theoretical framework to anchor the research.

The identified gap, coupled with the researcher's philosophical perspective and theoretical framework, guided the study's methodology, including the design of its data collection and analysis processes, the formulation of its aim, and the development of its research questions. Given the qualitative nature of the research, close interaction between the researcher and participants was necessary. Active engagement in data collection and analysis was also required. Therefore, reflexive practice was integral throughout the study (Creswell 2014). This reflexivity ensured that the researcher's voice, personal experiences, and role were acknowledged while safeguarding the study's integrity. Reflexive practice encompassed philosophical reflexivity, which considered the influence of the researcher's philosophical stance on the study and its methodology. It also encompassed personal reflexivity, reflecting on the researcher's positionality and its potential impact on the research process (Creswell 2014; Wisker 2019). These aspects are elaborated upon in subsequent chapters.

The introductory chapter establishes the foundation of the thesis by providing background and context. It outlines the research problem, states the research aim, questions, and objectives, discusses the significance of the study, and details the structure of the thesis.

1.2 BACKGROUND

Healthcare systems are complex units that serve society's diverse healthcare needs through the provision of various diagnostic and treatment interventions (Patel, Nadel and West 2014). At the pivot of this complexity are frontline health workers, defined by Patel, Nadel, and West (2014) as staff directly interacting with patients to deliver basic healthcare services. Historically, this term was predominantly used to include nurses and physicians (Lee *et al*. 2017).

However, the COVID-19 pandemic expanded this scope to include frontline radiology staff, given their critical role in diagnosing and managing COVID-19 and its complications (Chinene 2023). Despite this recognition, Chinene's (2023) systematic review revealed objections, with staff expressing concerns about not being fully acknowledged as frontline workers in some healthcare institutions.

The frontline role, however, entails significant risks. Kang (2011) and Mossburg *et al.* (2019) emphasised the burden of infection risk, citing numerous cases of nosocomial infections among healthcare workers. Similarly, Mengistu, Tolera, and Demmu (2021) highlighted the global prevalence of needle stick injuries, which often lead to viral infections such as Hepatitis B, Hepatitis C, and HIV (Prüss-Üstün, Rapiti, and Hutin, 2005; Nagao *et al*. 2007; Lee *et al*. 2017; World Health Organisation 2019). Respiratory-borne infections also pose a significant threat, as evidenced during the SARS epidemic when healthcare workers constituted a large proportion of infected individuals (Liu *et al.* 2012). The COVID-19 pandemic exacerbated these risks, with healthcare workers accounting for 10% of global infections as of July 2020 (World Health Organisation 2020). In South Africa, by August 2020, over 27,000 healthcare workers had been infected, and 240 had succumbed to the virus (South African Department of Health 2020a).

Radiology staff, like other frontline workers, faced heightened risks during the pandemic (Zanardo *et al*. 2020). Their frequent use of chest x-rays (CXR) and Computed Tomography (CT) scans for COVID-19 diagnosis and management compounded these risks, particularly amid shortages of infection prevention and control (IPC) equipment and protocols (Zanardo *et al*. 2020; Gitau 2020).

According to the National Institute for Occupational Safety and Health (NIOSH) (2008) and Chinene (2023), exposure to infections, hazardous substances, needle stick injuries, and other work-related stressors give rise to occupational stress, which has been a long-established concern among frontline workers. Furthermore, O'Boyle, Robertson and Secor-Turner (2006) and Galea *et al.*

(2020) noted that public crises have been associated with aggravated psychological distress. Studies conducted to establish the impact of crises on individuals during and after the SARS 1 outbreak, mass shootings, and hurricanes have indicated worrying levels of psychological distress. In other geographical locations, such as Ireland, there has been an increase between pre COVID-19 and post COVID-19 stress (Murphy 2023).

Galea *et al*. (2020) and Sun *et al*. (2020) argued that the influence of COVID-19 and its related consequences on global mental health has not been adequately addressed. In South Africa, high coronavirus anxiety scale scores among radiographers suggest probable dysfunctional anxiety, though the underlying causes remain unexplored (Venter *et al.* 2021). The South African National Research Foundation (NRF) (2020) and Galea *et al*. (2020) emphasised the urgent need for research on COVID-19's mental health repercussions, given the potential for prolonged and life-changing effects, as observed during the SARS 1 outbreak. Additionally, unresolved mental stressors among radiology workers have been associated with poor service delivery and inaccurate radiological diagnosis (Gam 2015; Fishman *et al*. 2018).

While international studies have investigated the mental health impacts of COVID-19 on healthcare workers, their focus has solely been on radiographers and radiologists in specific geographic locations (Peitl, Zatelazo and Karlovic 2020; Kang *et al*. 2020). Locally, in KwaZulu-Natal (KZN), Mchunu, Harris and Nxumalo (2022) explored the experiences of healthcare practitioners excluding radiographers. As a result, the unique experiences of frontline radiology workers who attend to more than half of all the patients either in a dedicated radiology department or in their respective wards and operating theatres have not been explored (European Society of Radiology (ESR) 2010). Manser (2009) and Oandasan *et al.* (2006) highlighted that while healthcare operates as a multidisciplinary team, it comprises professionals with distinct specialised knowledge and responsibilities. Consequently, the experiences during a pandemic cannot be extrapolated, as each professional group faces unique

challenges shaped by their roles and expertise (Rajkumar 2020). Moreover, Peitl, Zatelazo and Karlovic (2020) stressed that the results from the conducted studies cannot be extrapolated to any other profession, country, or geographical area. The repercussions of COVID-19 are unique to each location, as evidenced by the significantly variable epidemiological data. (Worldometer 2020).

In South Africa, healthcare discrepancies are notably pronounced due to the decentralised administrative structure of the public healthcare system at the provincial level (Wishnia and Goudge 2020). Provincial policies, public financial resources and service quality are managed at this level, leading to variations across provinces. Decentralisation of this nature creates significant disparities in service quality and resource allocation, particularly between public (government-funded) and private healthcare institutions (Wishnia and Goudge, 2020; Modisakeng *et al.* 2020).

KZN province, one of South Africa's most populated provinces, has faced persistent systemic issues in its healthcare infrastructure, especially in the public sector. Before the COVID-19 outbreak, the province reported significant occupational stressors affecting the healthcare workforce. These included aging or malfunctioning radiology equipment, deteriorating healthcare facilities, and shortages of critical personnel, such as radiographers and radiologists, within the eThekwini district, a major metropolitan area in KZN (Gam 2015; Thambura 2016; Parag and Hardcastle 2022; Cibane and Hoque 2024). These infrastructural and human resource challenges likely added strain to healthcare workers already burdened by the high prevalence of infectious diseases such as tuberculosis (TB) and HIV in the region (Naidoo, Tomita and Paruk 2020; Human Sciences Research Council 2024).

When the pandemic hit, these pre-existing stressors might have intensified, impacting the ability of healthcare workers to effectively manage the surge in COVID-19 cases and exacerbating their occupational stress levels. Additionally, inadequate mental health support reported by doctors and nurses

in KZN left many feeling unheard and unsupported during the pandemic (Dawood, Tomita and Ramlall 2022). While Lewis and Mulla (2020) examined the experiences of radiographers in Gauteng, their findings cannot be generalised to radiology departments in eThekwini due to differing provincial contexts and the district's unique challenges.

According to Li *et al*. (2020), health departments in China incorporated psychological support interventions as a pivotal step towards the control of the effects of the COVID-19 pandemic. Thereby aligning with van de Venter *et al.* (2021) and Chinene (2023)'s recommendations, which included support strategies to alleviate the potential negative impacts of a pandemic on the occupational and mental well-being of diagnostic radiographers. However, Cooper (2005) argued that despite the available mental-coping strategies, stress does not work well with a 'one size fits all' coping mechanism. Instead, evidence-based coping mechanisms have been shown to improve mental wellness (Ugwu, Ahamefule and Nwobi 2008). Therefore, empirically grounded recommendations to support mental health and well-being management would provide invaluable benefits to frontline radiology staff during health crises.

For these reasons, this study was both apposite and necessary in exploring the mental health and well-being experiences of frontline radiology staff during the COVID-19 pandemic within the context of the eThekwini district. Furthermore, resultant practical recommendations would support mental health and well-being coping strategies for frontline radiology staff in eThekwini during health crises. The study's findings, rooted in a resource-constrained setting, have the potential to inform future strategies for supporting healthcare workers in similar environments and to promote staff wellness during such crises.

1.3 PROBLEM STATEMENT

Frontline healthcare workers, as key players in the healthcare system, face a heightened risk of nosocomial infections, particularly during health crises such as the COVID-19 pandemic (Mossburg *et al*. 2019; WHO 2020). By May 2020,

at least 90 000 healthcare workers worldwide had contracted COVID-19 virus, including 3000 in South Africa (Mantovani 2020; NDoH 2020b). This number increased to 27,360 infected healthcare workers in South Africa by August 2020 (NDoH 2020a). Zanardo *et al*. (2020) highlighted that radiology staff, as frontline healthcare workers, are particularly exposed to COVID-19. Their risk is further aggravated by the increasing use of clinical imaging modalities in the diagnosis of COVID-19-associated complications. These increased demands occur alongside persistent challenges such as shortages of Personal Protective Equipment (PPE), lack of documented protocols, and equipment shortages (Gam 2015; Gitau 2020; Zanardo *et al*. 2020).

NIOSH (2008) and Galea *et al*. (2020) indicated that health crises not only increase infection risks but also exacerbate occupational stress, as frontline healthcare staff face heightened exposure to infectious diseases. Cavallo and Forman (2020) further noted that infection risk is not the sole concern, as the COVID-19 pandemic has adversely affected national economies. Anecdotal evidence and Cavallo and Forman's (2020) findings indicated significant revenue losses. Some parts of South Africa's private radiology sector experienced salary cuts of up to 50%. Given that South Africa's largest workforce demographic falls within the 25–54 age group (Organization for Economic Co-operation and Development 2020), many practising frontline radiology staff are likely breadwinners. The ongoing presence of the virus creates uncertainty around the resolution of these challenges, making it difficult to predict the extent of the mental health burdens they may face (Herman 2020). Consequently, prolonged exposure to these mental health stressors is expected, with significant long-term effects anticipated (Galea et al. 2020).

While preliminary studies suggest significant anxiety and fear among South African-based radiographers (van de Venter *et al*. 2021), detailed insights into the mental health experiences of individual frontline radiology staff in the eThekwini district remain scarce. Research on COVID-19's mental health impacts on frontline radiology staff has largely yielded context-specific findings that may not be generalisable to the unique geographic and systemic

challenges of South Africa's eThekwini district (Lewis and Mulla 2020; Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022; Hazell and Stork 2024). Additionally, local research has often excluded frontline radiology staff, focusing instead on broader healthcare roles (Mchunu, Harris and Nxumalo 2022).

Healthcare operates as a multidisciplinary field comprising specialised teams, each facing distinct stressors. As such, generalising experiences across professional groups is problematic (Manser 2009; Oandasan *et al*. 2006). The unique work environments and resource constraints faced by frontline radiology staff in the eThekwini district necessitate a dedicated investigation. Such focused research is essential to understand their mental health and well-being experiences, as well as their support needs during the pandemic. Gam (2015) and Fishman *et al*. (2018) highlighted that unresolved mental stressors among healthcare workers, particularly radiology staff, have been associated with poor service delivery. These consequences include burnout, absenteeism, poor patient care, increased image reporting errors, complaints, and litigation. The combination of these challenges and the lack of research on the mental health and well-being experiences of frontline radiology staff in the eThekwini district provided the impetus for this study.

1.4 AIM OF THE STUDY

The study aimed to explore the mental health and well-being experiences of radiology staff in the eThekwini district of South Africa during a health crisis.

1.5 RESEARCH QUESTIONS

The research questions were as follows:

1.5.1 Main research question

What are the mental health and well-being experiences of frontline radiology staff in the eThekwini district of South Africa during the COVID-19 pandemic?

1.5.2 Sub-questions

1. What professional duties and roles did frontline radiology staff undertake during the COVID-19 pandemic in the eThekwini district?
2. What personal and work-related challenges did frontline radiology staff experience during the COVID-19 pandemic?
3. How do radiology staff in the eThekwini district perceive and describe their experiences of mental health and well-being during the COVID-19 pandemic?
4. How do radiology staff in the eThekwini district perceive and describe the impact of COVID-19 and its related consequences on their mental health, well-being, and professional competence?
5. What coping strategies did frontline radiology staff adopt to manage COVID-19-related mental distress?
6. What practical recommendations can be developed to support the mental health and well-being of frontline radiology staff during health crises, based on their experiences during COVID-19?

1.6 RESEARCH OBJECTIVES

Based on the aforementioned research questions, the following research objectives were formulated:

1. To explore and interpret the mental health and well-being experiences of frontline radiology staff in the eThekwini district during the COVID-19 pandemic.
2. To identify the professional duties and roles assumed by frontline radiology staff during the COVID-19 pandemic.
3. To identify and describe the personal and work-related challenges faced by frontline radiology staff during the pandemic.
4. To explore and interpret radiology staff's perceptions and narratives relating to their mental health and well-being during the COVID-19 pandemic.

5. To analyse radiology staff's perceptions of the impact of COVID-19 on their mental health, well-being, and professional competence.
6. To identify the coping strategies employed by frontline radiology staff to manage mental distress during the COVID-19 pandemic.
7. To develop evidence-based recommendations for supporting the mental health and well-being of frontline radiology staff during future health crises.

1.7 SIGNIFICANCE OF THE STUDY

This study holds both clinical and theoretical significance by providing valuable insights into the mental health and well-being of frontline radiology staff, particularly in the context of the COVID-19 pandemic. It also addresses the research recommendation by van de Venter *et al.* (2021) for a qualitative exploration of South African-based radiographers' experiences to understand the possible reasons for their anxiety and fear.

The eThekwini district has long experienced occupational stressors, including radiology staff shortages and frequent equipment breakdowns (Gam 2015; Thambura 2016; Parag and Hardcastle 2022; Cibane and Hoque 2024). These pre-existing challenges create a unique working environment, making it difficult to generalise findings from other regions with different contexts. As such, this study offers context-specific insights into the mental health and well-being experiences of frontline radiology staff in the eThekwini district of KZN during the COVID-19 pandemic. In doing so, it contributes to the global discourse on healthcare workers' well-being in times of crisis.

The research also contributes to the growing body of knowledge by examining the specific experiences of frontline radiology staff in resource-constrained environments. The findings have important implications for improving mental health strategies and enhancing crisis preparedness, particularly as global health systems continue to face vulnerabilities to future pandemics. By focusing on an often-overlooked frontline group - radiology staff, the study provides a

detailed understanding of the pandemic's impact. These insights hold significant policy and practical relevance for under-resourced healthcare settings.

In addition, the study explores how COVID-19 has influenced frontline radiology staff's mental well-being and, in turn, their professional competence. This connection is critical, as unresolved mental stressors can negatively impact service delivery and diagnostic accuracy within radiology departments (Gam 2015; Fishman *et al.* 2018). By investigating this intersection, the study provides evidence to inform employee-centred strategies that support service quality during health emergencies.

Furthermore, the study aimed to offer practical recommendations to support the mental health and well-being of frontline radiology staff during health crises, drawing from their lived experiences during COVID-19. By addressing a critical gap in the literature, the research contributes to ongoing efforts to improve support for this essential workforce. The recommendations developed can be adapted by radiology departments to enhance staff mental wellness, and coping capacities during health crises. In doing so, the study advances the broader agenda of supporting healthcare worker resilience and well-being across diverse settings.

1.8 DELIMITATIONS

The following delimitations were applied to the study to maintain focus and ensure a manageable scope aligned with the study's aim, research questions and objectives:

- The study population was limited to frontline radiology staff (radiologists, diagnostic radiographers, and nurses) working in the eThekwini district of South Africa during the COVID-19 pandemic. The exclusion extended to other healthcare professionals who may also have experienced mental health challenges during the pandemic. Additionally, radiotherapists, nuclear medicine radiographers, and sonographers were excluded. Their

departments function independently, follow different protocols, and have distinct interactions with COVID-19 patients, which may result in differing challenges or experiences.

- The research was confined to radiology departments within the eThekwini district, encompassing both public and private healthcare sectors. This geographic focus aimed to capture the experiences faced by frontline radiology staff in a decentralised healthcare system while excluding broader national or international contexts.
- The study specifically focused on the period of the COVID-19 pandemic, reflecting on the experiences of frontline radiology staff during this particular health crisis.
- A qualitative phenomenological approach was selected to deeply explore the lived experiences and meaning-making processes of participants. Quantitative methods, which might have resulted in statistical generalisations, were intentionally excluded.
- Participants were purposively sampled to ensure they had direct frontline experience during the pandemic. Radiology staff without such exposure were excluded from participation.
- The study employed semi-structured interviews and focus group discussions, thereby limiting the scope to self-reported data.

1.9 STRUCTURE OF THE THESIS

The thesis comprises the following eight chapters:

CHAPTER 1: **OVERVIEW OF THE STUDY**

The chapter introduces the study with an account of the background, the definition of the research problem, research questions, the aim of the study, its significance, delimitations, and an outline of the thesis.

CHAPTER 2: LITERATURE REVIEW

This chapter gives a detailed analysis of the literature reviewed, showing where the current discourse lies.

CHAPTER 3: THEORETICAL FRAMEWORK

The theoretical framework of the research is discussed in detail.

CHAPTER 4: RESEARCH METHODOLOGY

A detailed account of the research paradigm, design, methodology, sampling procedure, data collection process, ethical considerations, and data analysis methods is provided.

CHAPTER 5: PRESENTATION OF FINDINGS

This chapter presents the findings of the data that were collected and analysed.

CHAPTER 6: DISCUSSION OF FINDINGS

This chapter discusses the results and trends presented by the collected data with reference to the available literature and theoretical framework.

CHAPTER 7: THE FRONTLINE RADIOLOGY STAFF MENTAL HEALTH SUPPORT FRAMEWORK

This chapter presents, illustrates, discusses, and validates the proposed framework to support mental coping among frontline radiology staff during health crises.

CHAPTER 8: SUMMARY, CONCLUSION, STRENGTHS, LIMITATIONS AND RECOMMENDATIONS FROM THE STUDY

A conclusion stating the answer to the research question and recommendations based on the findings is provided, supported by literature. The study's strengths and limitations are also presented.

1.10 SUMMARY OF THE CHAPTER

This chapter has established the foundation for the study, highlighting the critical need to explore the mental health and well-being experiences of frontline radiology staff during health crises, particularly within the resource-constrained context of South Africa's eThekwini district. It has positioned radiology staff as essential, yet often overlooked, members of the healthcare system whose experiences during the COVID-19 pandemic merit focused attention. The chapter has outlined global and local evidence of occupational stress and mental health repercussions among healthcare workers, emphasising the gaps in understanding the specific experiences of radiology staff in under-resourced settings.

In addition, the chapter has highlighted the distinct systemic and geographic challenges of the eThekwini district. It noted that these factors may have exacerbated mental health stressors during the COVID-19 pandemic. Through this overview, the chapter has demonstrated the study's relevance and significance by addressing knowledge gaps in the existing literature. It also highlighted the study's potential to inform context-specific and practical recommendations aimed at improving the mental health and well-being of frontline radiology staff during health crises.

Informed by these insights, the study sought to explore the lived experiences of frontline radiology staff based in eThekwini during a health crisis (the COVID-19 pandemic). The goal was to develop practical recommendations to enhance coping mechanisms and promote mental wellness. This research focus aligns with global calls for targeted studies that address healthcare worker resilience. The findings are expected to contribute to a broader understanding of the mental health needs of frontline radiology staff. The following chapters will build on this foundation.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Defined as a process of summarising, synthesising and critically evaluating the literature on a particular focus area, a literature review serves to identify existing patterns, gaps and areas for further exploration, resulting in a robust research foundation (Leite, Padilha and Cecatti 2019). The present chapter adopts this approach, presenting a comprehensive examination of relevant literature to contextualise the study's exploration of the mental health and well-being experiences of frontline radiology staff in the eThekwini district during a health crisis, as introduced in chapter one. Drawing on Onwuegbuzie and Frels (2016), the chapter serves not only to establish a solid starting point for the study but also to avoid redundancy and ensure that the research contributes novel insights, rather than merely 're-inventing the wheel.

In keeping with qualitative literature reviews, literature ranging from quantitative to qualitative was thematically synthesised. The synthesis was guided by the study's aim (outlined in chapter one) and the following critical questions, which were used to extract the relevant data (Lucas *et al.* 2007):

- What is the role of radiology in the context of COVID-19?
- What are the experiences and roles of frontline radiology staff during the COVID-19 pandemic?
- What coping strategies are identified in the literature and by frontline radiology staff for managing COVID-19-related mental distress?

The chapter begins by outlining the literature review process. It then provides an overview of COVID-19 and the role of radiology in its management, highlighting the critical contributions of the field during the pandemic. The discussion proceeds to explore the correlation between mental health and health crises. An exploration of the broader experiences of frontline radiology staff during such crises, both globally and within the South African context, is

also presented. The focus is on the impact of these events on radiology departments and staff mental health. The chapter concludes by discussing the mental health coping strategies employed by healthcare workers.

2.2 SOURCES OF LITERATURE REVIEWED

A rigorous literature search was conducted to determine the status quo of the topic under study (Leite, Padilha and Cecatti 2019). To achieve this objective, a structured search strategy was developed with the guidance of an experienced subject librarian, ensuring a comprehensive and unbiased search process. The search was conducted using EBSCOhost, a reputable platform known for its comprehensive access to high-quality academic literature. Using this platform enabled access to the following multidisciplinary databases: Medline, CINAHL, EMBASE, and PsycInfo (Onwuegbuzie and Frels 2016).

Considering the novelty of COVID-19, the bulk of the research articles were primary research studies. These included cross-sectional studies, case-control studies, cohort studies and randomised controlled trials (RCT). In keeping with (Lucas *et al.* 2007), the study's aim guided the formulation of the focused research question for the literature search: 'What are the mental health and well-being experiences of frontline radiology staff during a health crisis?' Subsequently, a Population, Issue, and Outcome (PIO) framework was developed to refine and narrow the focus of the search (Table 2.1). Within this framework, Population (P) referred to frontline radiology staff (radiologists, radiographers, and nurses). The Issue (I) referred to health crises, specifically COVID-19. The Outcome (O) focused on insights into lived experiences, challenges, and coping mechanisms related to mental health and well-being (Table 2.1).

Following the identification of key concepts, synonyms for each concept (Table 2.1) were noted. This step aimed to ensure an appropriate balance between the sensitivity and precision of the search strategy (University of Toronto Libraries 2023).

Table 2.1: EBSCO: Medline, CINAHL, EMBASE and PsycInfo search

Key concept (Population)	**Key concept (Issue)**	**Key concept (Outcome)**	**Limits**
Radiolog*	Covid*	Phenomenolog*	2019+
Radiograph*	Pandemic	"life experience*"	English Language
"Diagnostic imag*"	Coronavirus*	"Lived Experience*"	
"Medical imag*"	Coronavirus*	"focus group*"	
X-Ray*	SARS-COV*	("semi structured" or semistructured or unstructured or informal or in-depth or "face to face" or structured or guide or "open ended") N3 (interview* or discussion* or questionnaire*)	
Xray*	Sarscov*		
MRI	Sars-coronavirus*	***Broader:***	
"magnetic resonance imag*"	2019-ncov*	*Experienc**	
"ct scan*"		*Thoughts*	
"computed tomography"	**Subject Headings:**	*Feelings*	
	(MH "Coronavirus+")	*Views*	
Broader:	(MH "COVID-19")	*Perspective*	
"Frontline care"*		*Perception*	
"front line care"*		*Perceiv**	
"Frontline health"*		*Attitude*	
"front line health"*		*Opinion*	
doctors, dentists, midwives, nurses, paramedics, ambulance staff, pharmacists, optometrists, occupational therapists, physiotherapists.		*Emotions* *Coping strategies*	
Narrower:			
*Radiologist**		**Subject Headings:** (MH "Qualitative Research+")	
*Radiographer**			
"imag techn*"*			
Subject Headings:			
(MH "Radiologists")			

EBSCO's advanced search features, in accordance with UTL (2023), allowed the use of Boolean operators, 'AND, OR and NOT' to combine key concepts and implement the exclusion criteria. In addition, quotation marks and truncation were used to ensure an exhaustive search of all available and relevant research studies. Studies were automatically limited to those published from 2019 onwards, when the COVID-19 outbreak began (Ramphul, Mejias and

Ramphul 2020). Supplementary search strategies such as hand-searching and reference tracking were further utilised. Grey literature, including newspapers and government documents, was used to ensure a comprehensive search and further track any missed references (UTL 2023).

Appendix 19 provides a breakdown of the articles identified: 284 from databases, 10 through citation searching, and 30 from web searches. After removing duplicates, the screening process involved reviewing titles and abstracts, followed by full-text evaluation to determine relevance based on the population, issue, and outcome criteria. In total, 90 articles were included in the literature review, comprising 70 from databases and 20 from citation and web searches.

2.3 CORONAVIRUS DISEASE 2019 (COVID-19)

Emerging in Wuhan, China in December 2019, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) which results in the highly infectious COVID-19 has proven to be the most vicious coronavirus outbreak with evident drastic effects (Ramphul, Mejias and Ramphul 2020). COVID-19 has been recorded as one of the greatest acute threats to global health with a record of 673,709,318 cases worldwide and 6,749,490 deaths since its outbreak over three years ago (Worldometer 2023).

The first COVID-19 case in South Africa was recorded on the 5th March 2020, while the first fatality was reported 22 days later (National Institute of Communicable Diseases 2020). On 12 September 2020, global statistics stood at 28,659,731 confirmed cases and 919,718 deaths worldwide while 646,398 infections and 15,378 deaths were recorded in South Africa as the eighth highest leading country with regard to COVID-19 cases (Worldometer 2020). To date, statistics stand at 4,054,522 cases and 102,588 deaths in South Africa (Worldometer 2023). As of June 2020, at least 90 000 healthcare workers worldwide had contracted the virus (Mantovani 2020).

In South Africa as of August 2020, at least 27 000 healthcare workers had been infected and 240 had succumbed to COVID-19 (NDoH 2020a). Considering the longstanding use of radiology services in the diagnosis and management of patients, and the increased uptake of these services due to the efficacy of CXR and CT in diagnosing COVID-19 associated complications (ESR 2010), radiology staff are potentially exposed to COVID-19. They face this risk like any other frontline healthcare worker. Hence, an exploration of their experiences during the COVID-19 and the influence of the pandemic on their mental well-being is of paramount importance.

2.3.1 Diagnosis of COVID-19

COVID-19 is primarily diagnosed through use of Real-Time Reverse Transcriptase–Polymerase Chain Reaction (RT-PCR), other Nucleic Acid Amplification Test (NAAT) and antigen tests (Tesini 2022). As of 2022, COVID-19 tests could be accessed through laboratories, public testing centres or most conveniently at home. However, this was not the case during the time of data collection, as rapid tests and home tests had not been made available (Tesini 2022). Resultantly, delays in the availability of test results impacted individuals in two ways. First, it increased anxiety about the outcome. Second, it reduced productivity. This was because most national regulations required the individual to quarantine until they knew their COVID-19 status (Yu *et al.* 2020). Socially and mentally, COVID-19 suspects faced stigmatisation. People around them did not want to contract the virus. This fear arose in case the individual was indeed COVID-19 positive (Murphy *et al.* 2022).

2.3.2 Role of radiology in COVID-19 diagnosis and management

Although the primary diagnostic tools for testing for COVID-19 include RT-PCR and antigen tests, x-rays and computed tomography (CT) play a significant role in differential diagnosis, detection of COVID-19-related complications and prognostication (Kwee and Kwee 2020; Yu *et al.* 2020). Rousan *et al.* (2020) noted that approximately 50% of COVID-19 patients exhibited abnormal chest

x-ray findings, which typically peaked around five to ten days after symptom onset. Rousan *et al.* (2020) further emphasised that abnormal chest x-ray findings, such as Ground-Glass Opacity (GGO) in a peripheral distribution with a lower lobe predilection (Figure 2.1), are commonly associated with COVID-19 pneumonia. This highlights the important role of chest x-rays in the management of COVID-19 patients.

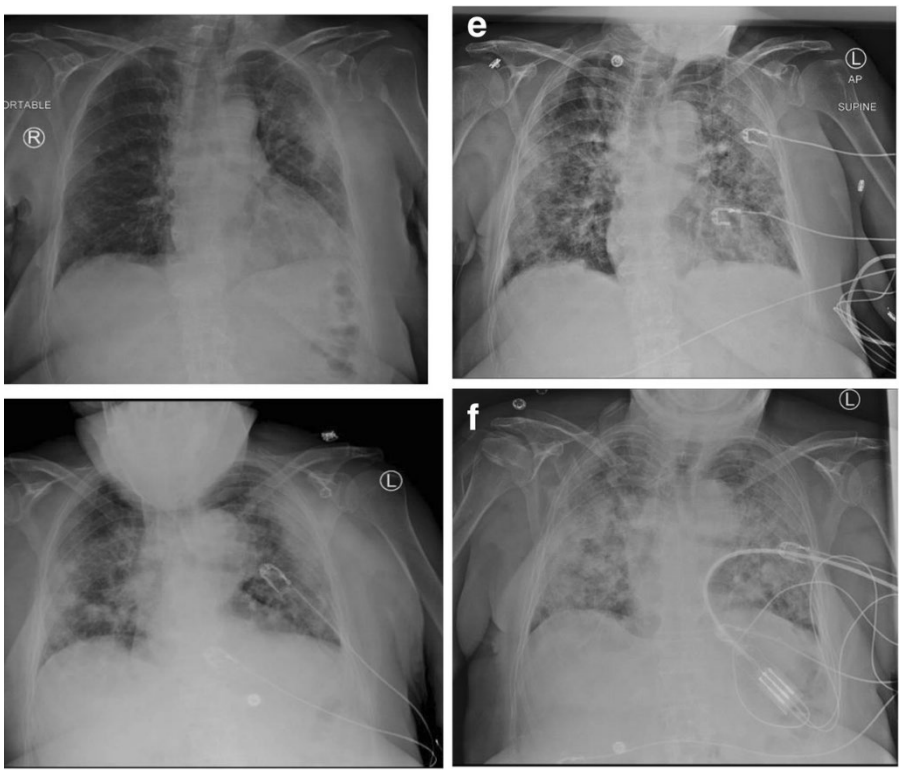

Figure 2.1: Chest x-ray findings and associated temporal lung changes in patients with COVID-19 pneumonia (Rousan *et al.* 2020).

During the early days of the pandemic, unenhanced High-Resolution Computed Tomography (HRCT) was considered an alternative tool for diagnosis. This was because it demonstrated 73% accuracy in COVID-19 patients and provided results in a short space of time due to its shorter scan times (Xu *et al.* 2020). CT images reveal pneumonia caused by COVID-19, characterised by *"multiple patchy ground-glass opacities in bilateral lobes with peripheral distribution."* Additionally, there is thickening of the adjacent pleura, as indicated by the arrows in Figure 2.2 (Xu *et al*. 2020). A retrospective study by Ord *et al.* (2022)

in Johannesburg, South Africa, corroborated these chest x-ray and CT imaging findings.

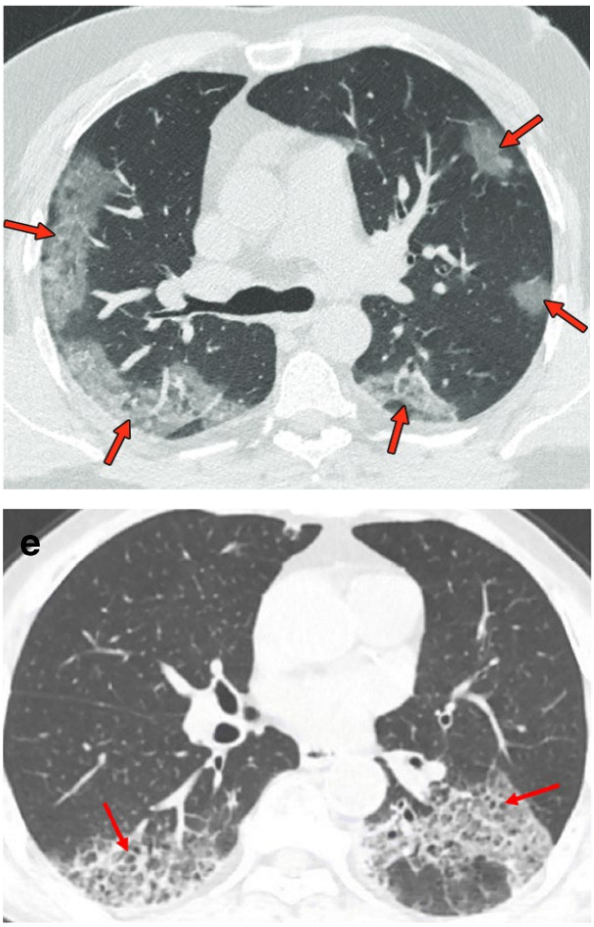

Figure 2.2: Axial non-contrast enhanced chest CT images (lung window) demonstrating COVID-19 pneumonia and thickening of adjacent pleura (Kwee and Kwee 2020; Xu *et al.* 2020).

Kwee and Kwee (2020) indicated that the use of CT in COVID-19 diagnosis and management requires strict infection control measures. It also requires optimisation of the chest CT protocol. Additionally, a standardised reporting system must be established. This system should focus on COVID-19-related pulmonary findings on CT images. Regardless of its acknowledged ability to aid with the diagnosis or differential diagnosis of COVID-19 pneumonia, CT presents with the risk of ionising radiation (United States Food and Drug

Administration 2017). Given the possibility of false-negative or false-positive results, as well as reliance on several dynamic variables, it proved difficult to rely solely on CT as a primary diagnostic tool (Kwee and Kwee 2020). These variables include reader experience, the diagnostic criteria used as threshold values, study population, COVID-19 prevalence, the stage of COVID-19, disease severity at the time of imaging, and coexisting lung disease (Kwee and Kwee 2020).

However, CT remains indispensable in the diagnosis of COVID-19 complications such as pulmonary embolism (PE), heart failure and Acute Respiratory Distress Syndrome (ARDS) (Kwee and Kwee 2020). Additionally, according to Prabhakar, Prabhakar, and Garg (2021), chest CT has proven to be invaluable in the post-recovery phase of COVID-19. It helps by ruling out fibrotic lung disease, which presents as a common COVID-19 long-term respiratory complication. Murphy *et al.* (2022) highlighted that interventional radiology also plays a significant role in managing COVID-19-related complications. This is evidenced by the increased demand for cardiac interventional services to manage COVID-19-related complications.

In addition to common interventional radiology procedures such as insertion of peripherally inserted central catheters (PICC), port-a-caths and haemodialysis lines and nephrostomies, an increase in peripheral angioplasty and embolisation cases during COVID-19 was noted (Murphy *et al.* 2022). Additionally, a significant number of interventional radiographers (75%) noted a sharp increase in cerebrovascular accidents (CVA) and other clotting conditions relating to COVID-19 (Murphy *et al.* 2022). Cardiac interventional services also experienced an increased influx of patients presenting with interventional radiology-treated myocardial infarctions, pulmonary embolism (PE) as well as other non-neurological, cardiac or pulmonary clotting disorders (Murphy *et al.* 2022). However, the impact of COVID-19 on the radiology services within the eThekwini district of KZN is unknown. Thus, giving impetus to this study, which aimed to explore the experiences of eThekwini-based radiology staff during a health crisis, specifically, the COVID-19 pandemic.

2.3.3 Prevention of COVID-19

The WHO came up with international guidelines to curb the virus, which was spreading like wildfire (WHO 2020). The Centres for Disease Control and Prevention (CDC) argued that this was mostly attributed to the mechanism of the spread of this virus, which involves the production of respiratory droplets during coughing and sneezing (CDC 2023a). The number of COVID-19 cases and deaths was increasing drastically in several countries, including South Africa. This resulted in several countries implementing full lockdowns to help prevent the spread of the virus. In South Africa, the total lockdown came into effect from the 27th March 2020 (Worldometer 2020; NICD 2020). In addition to lockdowns, the WHO also recommended the following measures as ways of minimising the spread of the COVID-19 virus (Kretzschmar *et al.* 2020; CDC 2023a):

- Handwashing to curb the spread of the virus by a significant percentage.
- Maintaining a social distance of approximately one metre from the nearest individual.
- Contact tracing.
- Wearing of face masks.
- Disinfection of hands with alcohol-based sanitisers.
- Avoiding mass gatherings.

2.3.4 COVID-19 related infection control measures in radiology departments

Considering the vast use of radiology in the management of COVID-19 positive patients and suspects, it is imperative to ensure prevention of COVID-19 nosocomial transmission during these procedures (Heng *et al.* 2020). Lewis and Mulla (2020) added that after the infection prevention and control (IPC) policies were issued by the WHO and adapted by the NDoH, South African-based radiology departments worked on contextualising these policies to help reduce the spread of the virus.

A study conducted in Singapore outlined several key factors. These included the appropriate use of PPEs, staff training, and the implementation of recommended infection control protocols. Together, these measures successfully prevented the transmission of COVID-19. The prevention occurred among patients and radiology staff involved in 1,637 COVID-19 positive related cases (Heng *et al.* 2020). These protocols included disinfection of radiology equipment, maintaining the recommended physical distance and segregation of staff and patients (Heng *et al.* 2020). For x-ray, ultrasound, CT, and interventional radiology procedures involving suspected or confirmed COVID-19 patients, the routine PPE includes N95 respirators, disposable fluid-resistant isolation gowns, surgical gloves, goggles, face masks with visors, and hair caps (Heng *et al.* 2020).

Radiology departments also implemented quarantine or isolation strategies for COVID-19-infected or suspectedly infected staff (Yu *et al.* 2020). In 2020, radiology departments in Hubei province, China, granted staff 21 days to isolate (Yu *et al.* 2020). However, this was different in South Africa, where the maximum isolation days were 10 days (NICD 2020; NDoH 2020c). Considering the increased workload in the public hospital-based radiology departments and the delays in test outcomes for RT-PCR, which used to take approximately two days (Yu *et al.* 2020), departments faced staff shortages during this period. Some radiology departments emphasised the use of paperless systems to minimise the risk of infection through paper handling of the radiology request forms and patients' files (Yu *et al.* 2020).

2.4 MENTAL HEALTH AND HEALTH CRISES

Defined by Patel, Nadel, and West (2014: 6) as professionals who directly interact with patients to provide basic medical services, frontline health workers play a pivotal role in the broader health system. Included in this category are radiology staff who attend to more than half of all the patients either in the dedicated radiology department or in their respective wards and operating theatres (ESR 2010). However, the job comes with the burden of infection risk

as several cases of nosocomial infections have been reported among healthcare workers (Mossburg *et al.* 2019). Based on their findings, Rapiti, Pruss-Ustun, and Hutin (2005) estimated 145 premature deaths due to the Hepatitis C virus (HCV), 261 premature deaths due to the Hepatitis B virus (HBV), and 736 premature deaths due to Human Immunodeficiency Virus (HIV). This data was collected from 14 geographical locations across Africa, the Americas, the Eastern Mediterranean, Europe, South-East Asia, and the Western Pacific.

O'Donnell *et al.*'s (2010: 516) study indicated that in South Africa, the rate of admission for the management of extensively drug-resistant Tuberculosis (XDR-TB) was approximately six times higher among healthcare workers than non-healthcare workers. Malangu and Legothoane's (2012: 44) study corroborated these findings by documenting 83.9% TB-related nosocomial infections among healthcare workers in Limpopo province, South Africa. Additionally, Cooch (2020) highlighted that a health crisis such as the COVID-19 pandemic exacerbates these long-standing risks. As of July 2020, approximately 10% of the COVID-19 positive individuals were frontline healthcare workers (WHO 2020). Like any other frontline healthcare worker, radiology staff are exposed to COVID-19 (Zanardo *et al.* 2020), which is a highly infectious respiratory disease (WHO 2020). Coupled with the increasing use of the chest radiograph (CXR) and the Computed Tomography (CT) scan in the diagnosis of COVID-19-associated complications, reported shortages of infection prevention and control (IPC) equipment and protocols aggravate this risk (Zanardo *et al.* 2020; Gitau 2020).

O'Boyle, Robertson, and Secor-Turner (2006), NIOSH (2008), and Galea et al. (2020) noted that occupational stress is a long-standing issue among frontline healthcare workers. This includes radiographers based in eThekwini, as highlighted by Gam (2015). Such stress tends to worsen during health crises, due to increased occupational exposure to infection. Galea *et al.* (2020) supported these conclusions with evidence gathered from studies conducted to establish the impact of crises on individuals during and post-SARS 1 outbreak,

mass shootings, and hurricanes. The studies reported worrying levels of psychological distress among the individuals who experienced these crises (Galea *et al.* 2020).

According to Liu *et al.* (2012), panic and anxiety levels were elevated among the survivors of SARS1 due to the associated high infectious potential and mortality rates. Liu *et al.* (2012) added that psychological morbidity increased noticeably among healthcare workers in the countries that were most affected by the outbreak. In addition, McAlonan *et al.* (2007) reported that frontline workers in Hong Kong continued to indicate elevated levels of depressive symptoms a year after the SARS 1 epidemic. Thereby aligning with the experiences of healthcare workers in Singapore who recorded Impact of Events Scale scores ≥30, indicating post-traumatic stress disorder (PTSD) (Chan and Huak 2004).

Health experts argue that the influence of COVID-19 and its related consequences on global mental health has not been extensively explored (Sun *et al.* 2020). Studies investigating the influence of a health crisis on individuals' mental health are regarded as a priority because, as indicated by Gam (2015) and Fishman *et al.* (2018), unresolved mental stressors among healthcare workers, particularly radiology workers, have been associated with poor patient care, increased image reporting errors, complaints, and litigation. This indicates a need to explore the experiences of radiology frontline staff during the COVID-19 pandemic to determine the influence of COVID-19 on their mental health.

2.5 EXPERIENCES OF RADIOLOGY STAFF DURING THE COVID-19 PANDEMIC: A GLOBAL VIEW

Studies investigating the experiences and repercussions of COVID-19 on the mental health of frontline healthcare workers have been conducted globally among doctors and nurses in several countries, including Iraq, China, the United Kingdom, and the United States of America (Peitl and Karlovic 2020; Kang *et al.* 2020). The studies recorded alarming levels of psychological

distress resulting from the fear of contracting the virus in the workplace and spreading the infection among their family members (Li *et al.* 2020). Akudjedu *et al*. (2020), Shanahan and Akudjedu (2021), Akudjedu *et al.* (2021) and Murphy *et al.* (2022) echoed these findings by reporting deteriorated levels of physical, social and mental well-being among diagnostic radiographers and interventional radiographers (IR) in Ireland, the UK, USA, Australia and Ghana (Figure 2.3). Between 80% and 70% of the radiographers complained that work during the pandemic was both tiring and high-pressured respectively, added Murphy *et al.* (2022).

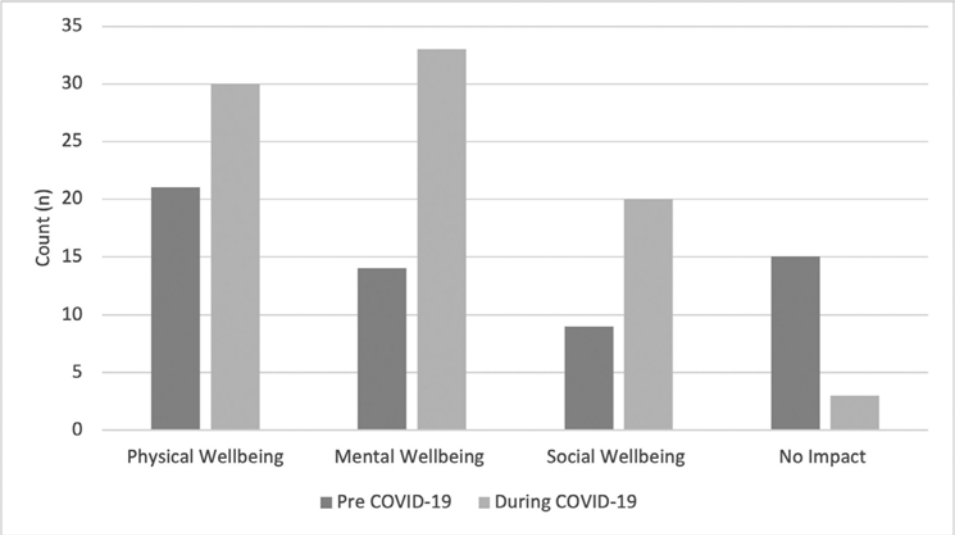

Figure 2.3: Impact of working in interventional radiology on physical, mental, and social well-being among interventional radiographers pre-COVID and during COVID-19 in Ireland (Murphy *et al.* 2022).

Murphy *et al.* (2022) reported that physically, the IR complained of increased incidences of musculoskeletal pain, fatigue, and physical strain from wearing PPE and lead shielding for prolonged timeframes. Swaminathan, Mukundadura and Prasad (2022) also indicated complaints of sweating and feeling suffocated among health workers following the wearing of PPE over long work shifts. This could be attributed to the materials used in manufacturing PPE, which is typically made from polypropylene fibre, and lead and rubber for lead shielding (Chemical Safety Facts 2022). Consequently, some departments are

transitioning to newer lead-free aprons that use alternative materials such as barium, tungsten, tin, or antimony, offering a similar lead weighting to conventional aprons (Cheon *et al.* 2018). Conventional lead rubber aprons are also very heavy, weighing approximately 7kg (Cheon *et al*. 2018). This is probably the reason for physical strain complaints reported by IR-based radiology staff (Murphy *et al.* 2022).

Regarding fatigue and physical strain, Murphy *et al.* (2022) reported that a few IR-based radiographers fainted as a result of fatigue from prolonged working hours and workload. The workload increased sharply, even though elective cases were cancelled. This rise was mainly due to a widespread increase in COVID-19-related conditions, including CVA and other blood clotting disorders. An additional factor was the crucial role of radiology in supporting differential diagnoses and detecting complications related to COVID-19 (Royal Australian and New Zealand College of Radiologists 2020; Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022).

Strict infection control protocols that were adopted in healthcare units increased preparation, procedures and after-procedures cleaning times as well as causing physical fatigue among radiology staff (Salih *et al.* 2022). According to Niu *et al.* (2020), in radiology departments equipment had to be disinfected between patients with ethanol or chlorine-containing liquid disinfectants, sprays or ultraviolet disinfectants. If a COVID-19 patient has made use of the room, a higher concentration of 1,000mg/L chlorine-containing disinfectants was recommended (Niu *et al.* 2020).

The increased workload and resultant fatigue coupled by closure of fitness facilities due to lockdowns, resulted in increased sedentary patterns among staff. Therefore, some staff complained that this affected their physical well-being as they were no longer as physically active as before. Additionally, those who resorted to physical activity for stress relief were severely impacted. As a result, staff increased their caffeine intake and spent more time on screens,

such as watching television, using smartphones, or browsing the internet, when not at work (Murphy *et al.* 2022).

Mental well-being was significantly impacted during the COVID-19 pandemic, with notable changes in occupational stress levels documented among interventional radiographers in Ireland (Figure 2.3; Murphy *et al*. 2022). Sipos *et al.* (2023) reported that radiographers in Singapore also experienced significantly high-stress scores and persistent concerns about their health. Anxiety levels increased, while sleep hours decreased, particularly among Ireland-based radiographers (Murphy *et al.* 2022). Globally, anxiety and work-related stress were frequently cited as the primary mental health effects of COVID-19 among radiographers (Foley *et al*. 2020; Akudjedu *et al.* 2021; Tay 2021; Flood, McFadden, and Shepherd 2022). Radiographers often relied on caffeine and increased watching television, using smartphones, or browsing the internet as coping mechanisms (Murphy *et al.* 2022).

Murphy *et al.* (2022) further noted that rising service demands led to staffing challenges, with some radiographers attending to critically ill patients. This exposure negatively affected their mental well-being, as they witnessed patients struggling to breathe (Figure 2.4). Many radiographers globally, including those in Ghana, Sweden, Ireland, and Northern Ireland, expressed anxiety about contracting the virus at work and transmitting it to family members, particularly those with underlying health conditions or advanced age (Foley *et al.* 2002; Akudjedu *et al.* 2021; Jorge and Fridell 2021; Murphy *et al.* 2022; Flood, McFadden and Shepherd 2022). Among radiographers in Ireland, 85% reported a sharp increase in occupational stress, and 87.5% experienced heightened feelings of social isolation following the outbreak of COVID-19 (Murphy *et al.* 2022).

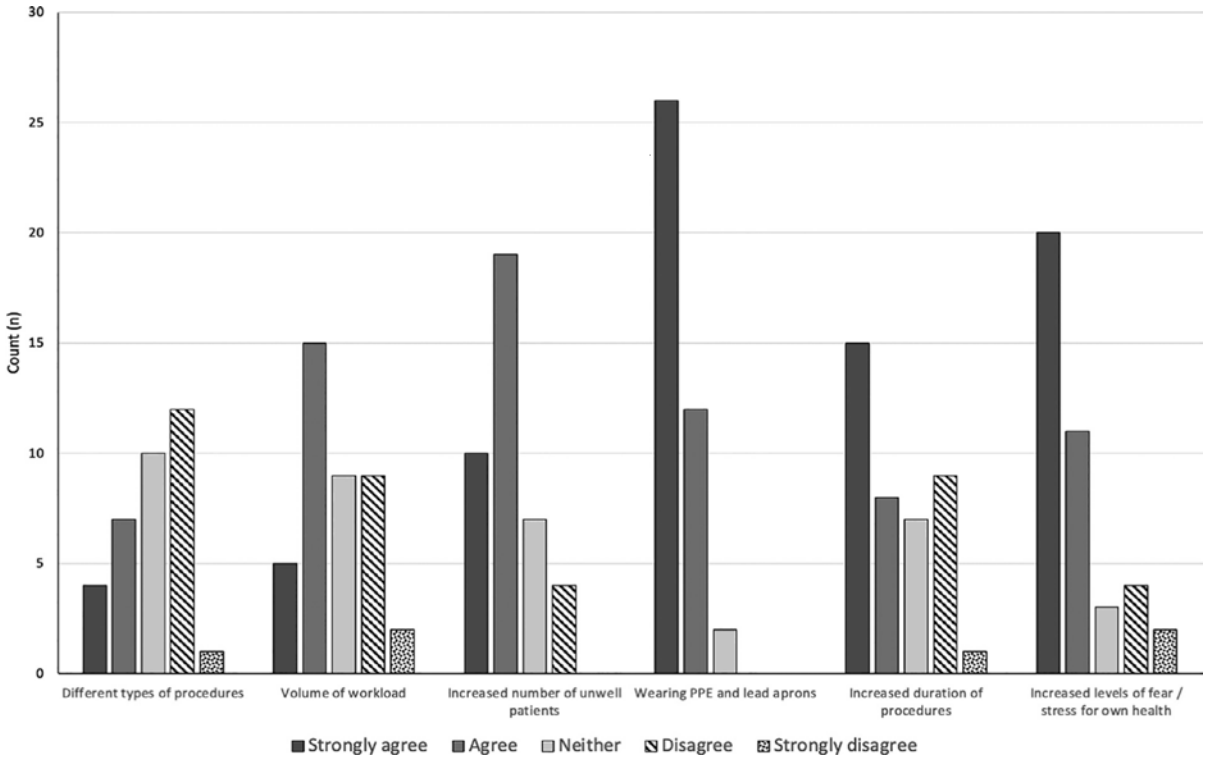

Figure 2.4: Factors contributing to deteriorated well-being among Ireland-based interventional radiographers when attending to COVID-19 patients (Murphy *et al.* 2022).

Social isolation emerged as a two-way phenomenon, primarily driven by radiology staff protecting their family members by limiting contact due to their high-risk work conditions during the COVID-19 pandemic (Foley *et al*. 2020; Murphy *et al*. 2022). In addition, stigmatisation was reported, as non-health worker friends and family avoided social interactions with radiology staff, fearing potential exposure to the virus due to occupational risk (Murphy *et al*. 2022). Stigma, however, was not solely external. Within the radiography profession in Singapore, colleagues reportedly stigmatised individuals who had been in contact with someone testing positive for COVID-19 (Afif, Razak and Choong 2023).

Interestingly, these challenges fostered closer relationships within radiologist and radiographer teams, as they shared similar experiences (Flood, McFadden and Shepherd 2022; Murphy *et al*. 2022). Furthermore, some institutions reported enhanced multidisciplinary teamwork and collegial support,

highlighting a collective resilience during the crisis (Flood, McFadden and Shepherd 2022; Murphy *et al*. 2022; Afif, Razak and Choong 2023).

These experiences are not unique to COVID-19, as the literature indicates that healthcare workers suffered anxiety and trauma during post-SARS1. Thereby confirming the psychosocial impact of pandemics on those at the forefront of caring for patients (Chan and Huak 2004). These findings also align with the American Institute of Stress (AIS) (2022). The AIS indicated that signs and symptoms of stress include excess anxiety, worry, insomnia, reduced work efficiency or productivity, constant fatigue, and increased smoking or alcohol intake (Wellness Council of America 2022). Additionally, WELCOA (2022) identified long hours, excessive workload, poor management, and worry about job security as common causes of occupational stress. These causes should not be left unaddressed because they have detrimental effects on both the company and the employee.

Akyurt (2021) highlighted that the Emotional State Scale (ESS) results of radiologic technicians in Turkey showed significant levels of a poor emotional state, low morale, and low happiness levels during the COVID-19 pandemic. These levels were notably higher compared to the phase before the outbreak of the pandemic. Resultantly, the radiologic technicians developed poor sleeping behaviours and social relationships, added Akyurt (2021). The all-encompassing causes for these negative outcomes were heavy workloads, lack of IPC training and awareness of the appropriate safety and risk management protocols regarding COVID-19. Yu *et al.* (2020) also concurred with Akyurt (2021) that radiologists and radiographers exhibited heightened anxiety and fear of contracting COVID-19. This was more noticeable among female healthcare workers, those of advanced age, as well as those with underlying co-morbidities (Akyurt 2021).

2.6 IMPACT OF THE COVID-19 PANDEMIC ON RADIOLOGY DEPARTMENTS

Murphy *et al.*'s (2022) study demonstrated differences in COVID-19-related experiences and challenges between radiology departments in public hospitals and those in the private sector. Murphy *et al.* (2022) indicated that in Ireland, the interventional radiology departments within public hospitals attended to most of the COVID-19 positive patients. Although private radiology departments did not attend to many COVID-19 positive patients, their elective lists were disrupted. This could have been due to the lockdown measures implemented by several countries (Naidich *et al.* 2020; NDoH 2020b). Consequently, elective cases were cancelled to minimise the spread of COVID-19 as well as ensure the availability of healthcare resources for COVID-19 patients (Naidich *et al.* 2020). Public hospital-based interventional radiology departments experienced significant staff shortages due to the increased demand for services by patients with COVID-19-related clotting conditions and CVA, as well as staff absences (Murphy *et al.* 2022).

These findings resonate with the outcome of a survey conducted in Canada, which highlighted the closure of outpatient diagnostic imaging departments during the early phase of COVID-19 (Maizlin and Ohorodnyk 2020). Maizlin and Ohorodnyk (2020) further explained that the closure was attributed to a substantial reduction in the number of referral cases for Bone Mineral Density (BMD) and mammography screening. Additionally, staff shortages, safety concerns, and the cancellation of elective cases contributed to this outcome. Naidich *et al.* (2020) concurred with these findings as their results indicated a decrease in patient statistics in 2020 when COVID-19 hit New York City.

Radiology outpatient departments were impacted the most as they faced an 88% reduction. Furthermore, patient statistics across different radiology modalities were impacted to varying degrees, with mammography experiencing the greatest reduction (94%), followed by nuclear medicine (85%), MRI (74%), ultrasound (64%), interventional radiology procedures (56%), CT (46%), and

general x-rays (22%) (Naidich *et al.* 2020). The comparatively lesser declines observed in CT and general x-rays statistics can be attributed to their increased use in the management of suspected infected or positive COVID-19 patients (Kwee and Kwee 2020; Yu *et al.* 2020). This correlates with findings from African countries such as Ghana. Despite the resource constraints, the daily use of x-rays and CT was significant. The total number of patients was initially significantly reduced due to the full lockdowns and peaked when lockdowns were alleviated (Akudjedu *et al*. 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022).

Due to the acute nature of COVID-19, healthcare departments were not prepared for this medical emergency. The lack of preparedness was shown by shortages of PPE in some parts of the world. Additionally, there was a global shortage of sufficient IPC measures in radiology departments (Akudjedu *et al*. 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022). In 2020, only 40% of Chinese-based radiology staff based in Hubei province demonstrated adequate knowledge of the infection preventive measures related to radiology (Yu *et al.* 2020).

Yu *et al.* (2020) highlighted that flaws in patient triaging often resulted in asymptomatic COVID-19-positive patients being mixed with negative patients in the radiology department. This posed a significant challenge in preventing the spread of the virus, as patients shared equipment. The issue arose from triage being based on symptoms, exposure history, and temperature (Yu *et al.* 2020). In Hubei province, patients were initially triaged at the entrance. Those who met the epidemiological criteria or had a fever were directed to the fever clinic via a dedicated pathway, identified as 'Private Channel and Accompanying' by Yu *et al.* (2020), where medical history was taken, and samples were collected. Afterwards, they proceeded to the radiology department. Patients assigned to other departments had their temperature and exposure history reassessed at the nurse station. Suspected COVID-19 patients were then redirected back to the fever clinic.

Yu *et al.* (2020) further explained that the layout of radiology departments and inadequate isolation strategies posed a significant challenge. In several cases in Hubei province, these issues led to the infection of radiology staff. The infections were classified as hospital-acquired (HAI), as investigations traced them to the departments' failure to separate COVID-19 patients and suspects from non-COVID-19 patients (Yu *et al.* 2020).

2.7 EXPERIENCES OF RADIOLOGY STAFF DURING THE COVID-19 PANDEMIC: A SOUTH AFRICAN VIEW

The surveys conducted in South Africa revealed significant challenges and negative impacts of COVID-19 on radiology departments and their staff (Lewis and Mulla 2020; van de Venter *et al*. 2021; Lewis 2023). Despite the implementation of WHO-recommended infection control measures in Gauteng, radiology staff experienced confusion and inconsistency. Existing imaging and IPC protocols were frequently modified. As a result, some staff were unaware of the current protocols or had not received adequate training. The lack of preparedness potentially heightened the risk of virus transmission (Lewis and Mulla 2020; Hazell and Stork 2024).

In South Africa, these issues were exacerbated by shortages of PPE and delayed COVID-19 test results, compromising infection prevention and control (IPC) measures (Lewis and Mulla 2020). Hazell and Stork (2024) further noted that radiographers in Gauteng faced limited and poor-quality PPE supplies, a situation attributed to corruption in procurement processes. As a result, some staff were compelled to bring their own PPE (Lewis and Mulla, 2020). Due to ongoing shortages, PPE was reused despite contravening standard infection control protocols. This practice added further stress for staff who were accustomed to single-use policies for infections such as tuberculosis (Hazell and Stork 2024).

Radiology departments based in Gauteng encountered additional challenges. These included discomfort from prolonged use of PPE due to increased workloads, difficulties in maintaining social distancing within departments, and inadequate communication from referring doctors regarding PUI or relevant clinical histories. Staff also reported frustration with work shift changes introduced to manage overwhelming workloads, as these disruptions to personal and family life contributed to increased mental strain (Lewis and Mulla 2020). Increased workloads resulted in extended working hours, further compounding stress. While van de Venter *et al*. (2021) reported high coronavirus anxiety scale scores among staff, their survey did not explore the underlying causes. Hazell and Stork (2024) highlighted that infection prevention measures, such as dividing teams into smaller groups, led to social isolation as colleagues went extended periods without interaction.

Financial stress was another significant issue. Radiographers in the private sector experienced salary cuts due to reduced patient numbers, as public healthcare facilities handled most COVID-19 cases (Lewis and Mulla 2020). This financial strain, particularly for breadwinners with monthly obligations, likely exacerbated stress (OECD 2020; Herman 2020). However, the limitations of online questionnaires restricted a comprehensive exploration of the full impact of salary cuts on the lived experiences of affected radiographers (Lewis and Mulla 2020).

Emotional challenges were widespread among radiographers. Fear of contracting and spreading the virus, attending to severely ill COVID-19 patients, and witnessing illness and death among colleagues heightened anxiety and emotional distress (Lewis and Mulla 2020; Hazell and Stork 2024). Information overload and misinformation also contributed to emotional strain, although this improved over time with increased familiarity and the introduction of vaccines (Lewis 2023). A lack of management support was frequently cited, prompting radiographers to rely on peer support to foster collective resilience (Lewis 2023).

Despite these findings, no known studies have examined the experiences of radiology staff in the eThekwini district of KwaZulu-Natal (KZN) province, South Africa. Peitl and Karlovic (2020) and Kang *et al.* (2020) cautioned that findings from other regions cannot be generalised due to significant differences in epidemiological data, economic conditions, and healthcare systems. In South Africa, the healthcare system operates at both national and provincial levels. While the National Department of Health oversees policy and strategic planning, service delivery and public financial management are managed independently by the nine provincial Departments of Health (Figure 2.5; Wishnia and Goudge 2020). Each province has unique healthcare dynamics shaped by its geography and economy, making it critical to contextualise findings within specific regions.

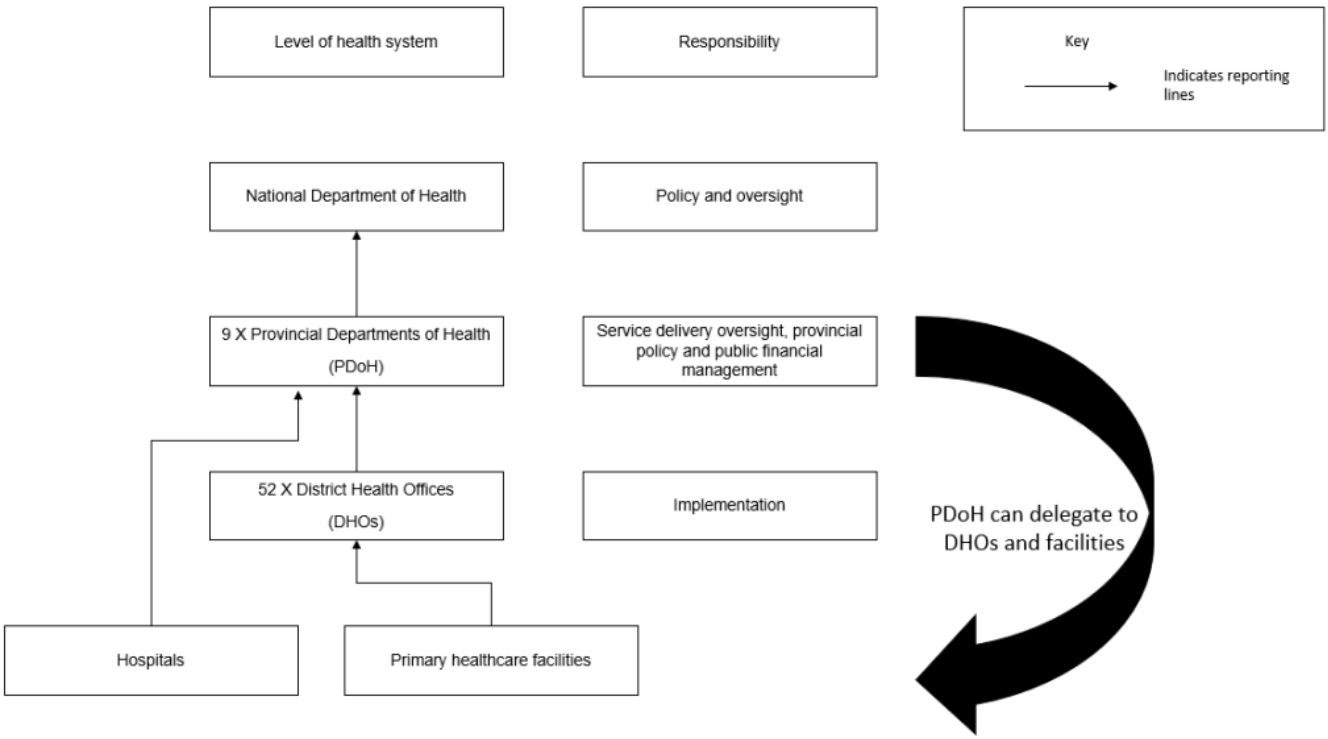

Figure 2.5: Structure of South Africa's healthcare system (Wishnia and Goudge 2020)

The Gauteng province, South Africa's wealthiest, differs significantly from KZN, where eThekwini district is located. Gauteng's provincial gross domestic product is double that of KZN (Stats South Africa 2023). As eThekwini district operates its own health office, implementing provincial policies at the primary healthcare level, hospitals in the district report directly to the provincial department (Wishnia and Goudge 2020). Figure 2.5 illustrates this decentralised system, highlighting the unique operational structures within each province. These distinctions emphasise the importance of investigating the mental health and well-being of radiology staff in eThekwini independently from findings in Gauteng province.

Gam (2015) identified occupational stressors unique to eThekwini radiographers. These included heavy workloads caused by high patient volumes, chronic equipment failures, staff shortages, and extended shifts. The findings align with longstanding reports of similar challenges in both the district and the province (Thambura 2016; Cibane and Hoque 2024). These consistent challenges highlight the need to address a knowledge gap by exploring the mental health and well-being of radiology staff in the eThekwini district during a health crisis, an area not yet examined in existing studies.

2.8 MENTAL HEALTH COPING STRATEGIES

The WHO defined mental health as '*a state of wellbeing in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to his or her own community'* (WHO 2001). Mental disorders, also known as psychological or psychiatric disorders, create distress which severely impacts multiple areas of an individual's life (Cherry 2020). Li *et al.* (2020) reported that globally, various health departments are emphasising the increase in psychological support interventions as a pivotal step towards the control of the effects of the COVID-19 pandemic. Thus, aligning with van de Venter *et al.*'s (2021) recommendations following heightened coronavirus anxiety scale scores among South African-based radiographers.

High levels of anxiety and post-traumatic disorder prevalence among healthcare workers during and following pandemics necessitate the need for psychosocial support and intervention for healthcare personnel (Chan and Huak 2004). LeBlanc (2009) emphasised that if unaddressed, occupational stress can negatively impact an individual's work performance, memory, attention level, group performance and decision-making. Studies have linked emotional or psychological distress with an increase in radiological diagnosis errors, poor patient care, and increased litigations (Gam 2015; Fishman *et al.* 2018). Murphy *et al.* (2022) and Daniel (2019) echoed these findings by indicating that diminished well-being can potentially impact productivity as a result of burnout. Resultantly, absenteeism, employee turnover and medical compensation can increase significantly and impact staff retention to a large extent (Daniel 2019; WELCOA 2022). The consequences of impacted staff retention cannot be overemphasised. Thereby indicating a need to develop an evidence-based mental health-coping framework. Such a framework would address the specific psychological challenges and circumstances faced by frontline radiology staff (Akudjedu *et al*. 2020: 1; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021 and Murphy *et al.* 2022).

WELCOA (2022) indicated that stress should be managed effectively, with the negative effects of stress minimised. Moreover, Cooper (2005) stressed that despite the available mental health coping strategies, stress does not work well with a 'one size fits all' coping mechanism. Hence, evidence-based coping mechanisms should be prioritised. The diverse experiences and challenges faced by different categories of healthcare workers (Rajkumar 2020) make it difficult to rely on a universal needs assessment for an Employee Assistance Programme as suggested by Daniel (2019). According to Bridger, Morton and Day (2013), a longitudinal study conducted in the UK between 2007 and 2013 indicated that occupational psychological strain, accompanied by the unavailability of coping resources or support, resulted in a significant number of employees (participants) leaving their jobs within the five years. Continued exposure to physical and mental strains potentially activates the hypothalamic-

pituitary-adrenocortical (HPA) axis, resulting in increased blood cortisol levels (Bridger, Morton and Day 2013; Michaud *et al.* 2008).

Hemingway and Smith (1999), Fishman *et al.* (2018), and Mohamed, Rosenkrantz, and Recht (2020) conducted studies on various healthcare workers. These included radiotherapists, oncologists, nurses, and CT technologists. Their research recognised that evidence-based strategies enhance mental wellness and occupational performance in these target populations. Hemingway and Smith (1999), Fishman *et al.* (2018), and Mohamed, Rosenkrantz, and Recht (2020) added that the effectiveness of these strategies is due to their focus on the specific causes or settings of mental health deterioration. Therefore, an evidence-based mental health-coping framework would be of invaluable benefit to current frontline radiology staff during health crises. However, to date, there is no known mental health-coping framework tailored to the mental support needs of radiology staff during health crises. This has been evidenced by authors who have corroborated the need for this one-of-a-kind framework (Akudjedu *et al.* 2020; van de Renter *et al.* 2021; Akudjedu *et al.* 2021; Shanahan and Akudjedu 2021; McFadden *et al.* 2022; Murphy *et al.* 2022).

Mind (2022) defined mental health coping strategies as tactics that are implemented to help alleviate, endure or tackle stressful experiences. Lazarus and Folkman (1984) formulated the two main coping strategies: emotion-focused and problem-focused. Emotion-focused strategies aim to change the stressed individual's response to the stressor without altering or eliminating the external stressor. These strategies can be achieved through emotional support, positive appraisal, acceptance or spiritual support (Figure 2.6; Cooper *et al.* 2006). In addition to planning, instrumental support and active coping, problem-based coping utilises any problem-solving techniques so as to manage or eliminate the stressor (Lazarus and Folkman 1984). Dysfunctional coping strategies are self-destructive and maladaptive. Examples include substance abuse, venting and behavioural engagement (Figure 2.6). The choice of coping style depends on the stressor, their personal preferences of the affected

individual, as well as the availability of support or tools to facilitate the coping strategy (Lazarus and Folkman 1984).

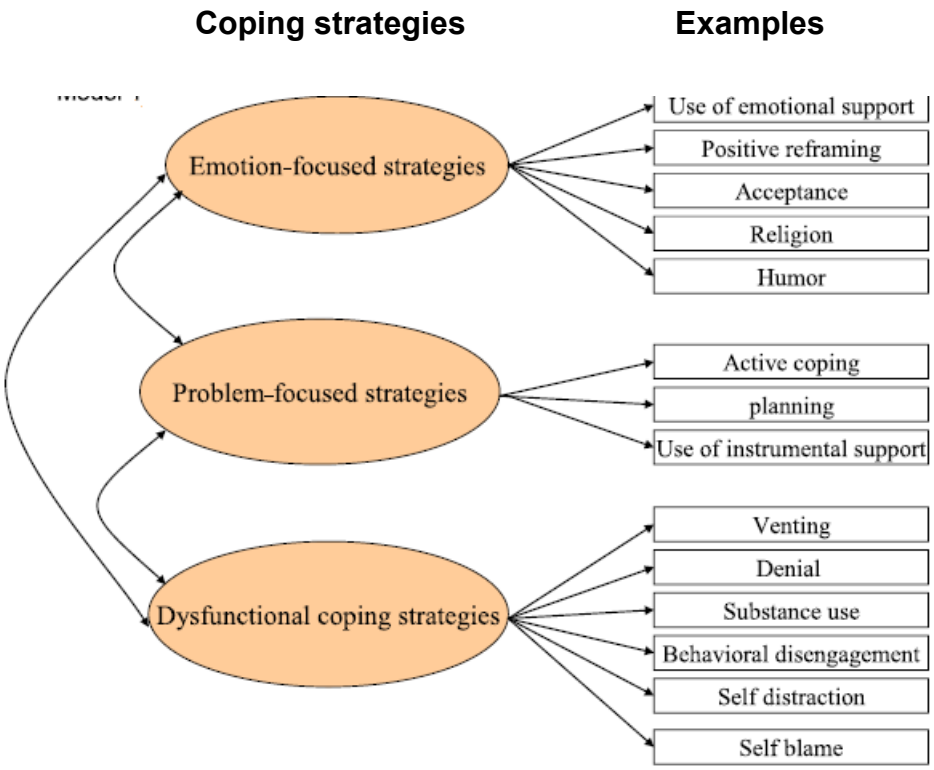

Figure 2.6: Categories of mental health coping strategies (Cooper *et al.* 2006).

2.9 SUMMARY OF THE CHAPTER

This chapter has provided insight into radiology staff's mental health and well-being experiences, particularly during health crises such as the COVID-19 pandemic. It highlighted the significance of the current study and identified a gap in the existing literature concerning the mental health and well-being experiences of frontline radiology staff in the eThekwini district. The review further emphasised the context of South Africa's healthcare system, particularly the challenges faced by radiology staff in resource-limited settings such as the eThekwini district. Building on the researcher's initial considerations, the insights gained from the literature will inform the development of the study's theoretical framework in the following chapter. Moreover, the study's findings

will revisit this literature within the discussion chapter to compare the data and demonstrate how the current study addresses the identified knowledge gap in the eThekwini context.

CHAPTER 3: THEORETICAL FRAMEWORK

3.1 INTRODUCTION

The current chapter presents the theoretical framework of the study. Collins and Stockton (2018) emphasised that research and theory have a symbiotic relationship in which theory informs research, while the findings of research inform theory. In line with this, the chapter offers an extensive discussion that includes definitions, strengths, limitations, and the rationale for the chosen theoretical framework. It begins with an overview of theoretical frameworks, including a discussion of the models and theories considered during the development process. Finally, it provides a detailed explanation of how the researcher arrived at the study's theoretical framework and how it is applied within the context of the research.

3.2 THEORETICAL FRAMEWORK OVERVIEW

Defined as a foundational review of theories serving as a roadmap for establishing arguments in a study (McCombes 2022), theoretical frameworks are constructed to aid in explaining, predicting, and understanding a phenomenon. They achieve this through challenging and extending existing knowledge within the limits of critical bounding assumptions (Abend 2008; University of Southern California USC 2022).

Some authors have argued against the role of theories in qualitative research. However, recent theorists have outlined that this concern applies solely to grounded theory and not to all other qualitative designs. This stems from the understanding that the researcher comes to the study with preconceptions which would potentially benefit from being guided by theory (LaMorte 2022). In addition to imparting the researcher's epistemological views, theoretical frameworks provide guidance on the appropriate methodology for a research

study. They also offer a lens through which new knowledge will be processed (Collins and Stockton 2018).

A theoretical framework can be based on either a theory or a model. According to Glanz, Rimer, and Viswanath (2015), a theory is defined as a structured set of connected concepts, definitions, and propositions. It provides a systematic perspective on events or situations by identifying variables to explain and predict them. In contrast, a model is a combination of concepts drawn from various theories. These are brought together to help understand a specific issue in a particular context. By combining elements from different theories, a model can offer a more comprehensive understanding of complex problems (Glanz, Rimer, and Viswanath 2015). Both models and theories comprise concepts, which are fundamental ideas or factors that serve as the core components or building blocks of the model or theory (Hayden 2023).

To facilitate a deeper understanding of the mental health and well-being experiences of clinical radiology staff in eThekwini district, the application of an appropriate theoretical framework was essential. Accordingly, the following sub-sections present an overview of the two models and one theory considered in this process.

3.2.1 Transactional Model of Stress and Coping

Introduced by Dr Richard Lazarus in 1966 and refined in 1984 with the aid of Dr Susan Folkman, the transactional model of stress and coping is reputably commended as the cornerstone of psychological stress and coping research in various fields (Biggs, Brough and Drummond 2017). Since models are designed to illustrate how processes function, they break these processes into specific components, relationships, and mechanisms. They provide a visual representation of phenomena to enhance understanding or prediction (Fried, 2020; Smaldino, 2020). Lazarus and Folkman (1984) developed their model to improve understanding of the processes underlying stress and how they influence individuals' coping efforts. According to their framework, stress results

from a transaction between an individual and their environment, mediated through a system of appraisals, responses, and coping mechanisms (Figure 3.1).

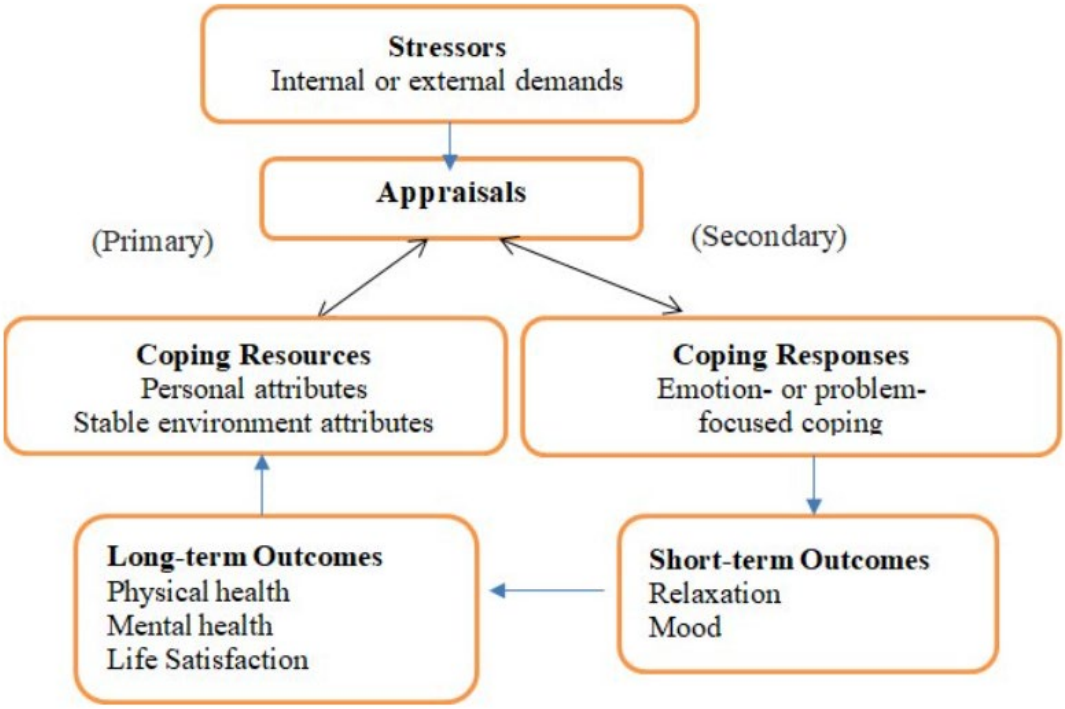

Figure 3.1: Transactional model of stress and coping by Lazarus and Folkman 1984 (Kagwe, Ngigi and Mutisya 2018).

Biggs, Brough and Drummond (2017) explained that stimuli or stressors within the individual's environment can be major life events or daily hassles, which directly impact the individual's emotional well-being. Furthermore, in accordance with Biggs, Brough and Drummond (2017), although the stressors can be the same, for instance, in this study, working in a healthcare environment during the COVID-19 pandemic, the impact of this stressor on different individuals varies. This variation depends on each person's perception filters. Personality, age, culture, gender, disability, and social class are among the individual differences that could potentially influence the individual's perception of the stressor (Ford *et al.* 2015).

Each individual, which in this case would be the frontline radiology staff, assesses the stressor and categorises it as either positive, dangerous or irrelevant through the primary appraisal process. Categorising the stressor as dangerous places the stressor as either a threat, harm or challenge depending on the individual's cognitive process (Lazarus and Folkman 1984). Following this, the individual (frontline radiology staff) undertakes the secondary appraisal process, through which they evaluate possible solutions as well as their capability to address the stressor or cope with it (Lazarus and Folkman 1984). This means the frontline radiology staff analyse the availability of resources to aid in managing the stressor. The outcome of this analysis can be sufficient or insufficient resources, with the latter leading to stress (Ford *et al.* 2015).

The WHO (2023) and Mental Health Foundation (MHF) (2021) defined stress as the body's physical, emotional or psychological response to pressure, overwhelm or inability to cope with mental or emotional pressure. The MHF (2021) added that stress is often triggered when an individual encounters a new or unexpected event or circumstance that leaves them overwhelmed and feeling that they are not in control of the situation. Despite previous cases of SARS outbreaks, COVID-19 is a unique pandemic. The world, including radiology departments, were not prepared for it (Zanardo *et al.* 2020). This could potentially lead to strain or stress among frontline radiology staff. With regard to coping mechanisms, they can broadly be grouped into either problem-focused or emotion-focused, followed by reappraisal (Lazarus and Folkman 1984). Within the radiology department, problem-focused coping could be practical solutions to the challenges encountered during practice. Emotion-focused coping would involve the frontline radiology staff changing their emotional relationship to the stressor.

The TMSC has limited applicability in experimental research because of its subjective nature (Lazarus and Folkman 1987). However, this limitation was not a concern for the current study, as a qualitative approach was utilised. The argument that TMSC is a very simplistic model was considered. This is because it does not account for social and environmental factors, as well as physiological

perspectives, in response to a stressor (Lazarus and Folkman 1987). This limitation was addressed by incorporating the HBM and AT in the study's theoretical framework.

The TMSC formed part of this study's theoretical framework as it assesses the influence of major life events, daily challenges and occupational stress on an individual's mental well-being (Lazarus and Folkman 1984). Additionally, it acknowledges the individual's perception of stressors, appraisals and coping. This was invaluable to the study, particularly in understanding the participants' lived experiences, which would be vastly subjective (Lazarus and Folkman 1984).

The use of this model is diverse as evidenced in the various studies where it has been incorporated. The TMSC has been utilised in studies on occupational stress and coping. It has also been applied in several studies exploring the lived experiences and coping mechanisms of patients suffering from chronic illness, as well as the families caring for such patients (Kagwe, Ngigi and Mutisya 2018; Loewenstein, Barroso and Phillips 2019; Sousa and Veronese 2022). Moreover, its emphasis on cognitive appraisal and coping strategies was invaluable. These elements played a key role in the development of the proposed evidence-based framework to support mental health coping among frontline radiology staff.

3.2.2 Health Belief Model

According to Glanz and Bishop (2010), the Health Belief Model (HBM) was one of the first models developed to predict health behaviours. The HBM was originally developed in the 1950s to help explain why individuals were not making use of readily available public health services. Over the years, the model has been modified to address various intervention and prevention-related concerns (Glanz and Bishop 2010; Glanz, Rimer, and Viswanath 2015). Recently, Mukhtar (2020) proposed its use in relation to COVID-19 and associated concerns.

Janz and Becker (1984) and Rosenstock, Strecher, and Becker (1988) explained that the core constructs of HBM; perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action, determine an individual's willingness to engage in health-promoting behaviours (Figure 3.2). Furthermore, these perceptions are affected by modifying variables such as psychological characteristics and demographic variables (Janz and Becker 1984). Collectively, this was invaluable in guiding the current study since several subjective factors influenced the participants' perception of the stressor, appraisal and coping mechanisms.

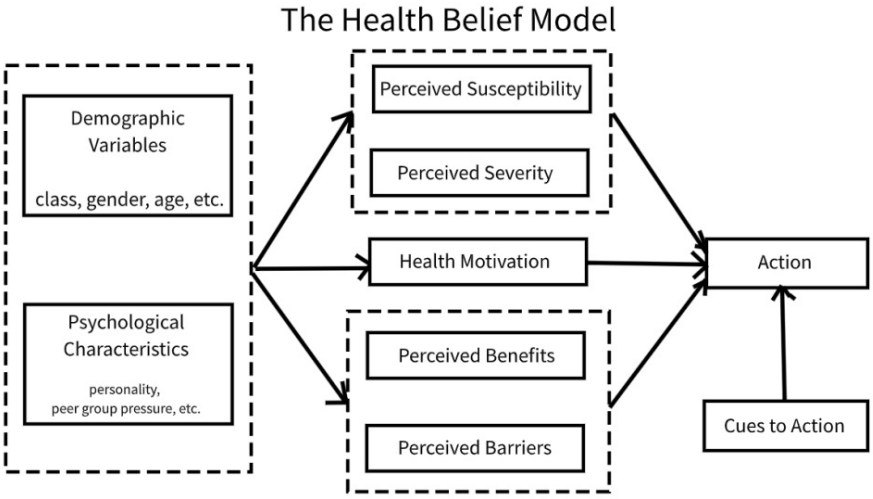

Figure 3.2: The Health Belief Model (Fanwang 2019).

HBM constructs and prepositions can be explained as follows, *'The model defines the key factors that influence health behaviours as an individual's perceived threat of sickness or disease (perceived susceptibility), belief of consequence (perceived severity), potential positive benefits of action (perceived benefits), perceived barriers to action, exposure to factors that prompt action (cues to action), and confidence in ability to succeed (self-efficacy).'* – (Rural Health Information Hub 2018).

Carpenter (2010) elaborated that health-promoting interventions can be developed by targeting HBM's core constructs. Therefore, the HBM served as a useful tool in developing the evidence-based mental health coping framework. This was based on the perceived barriers and other factors identified in the experiences of frontline radiology staff during the COVID-19 epoch. The HBM is more descriptive than explanatory. It does not suggest a strategy for changing health-related actions, nor does it account for environmental or economic factors that may prohibit or promote the recommended action. For this reason, Attribution Theory (AT) was integrated, as it considers the environmental context (LaMorte 2022). Additionally, incorporating AT helped address a key limitation of the HBM. The HBM assumes that everyone is aware of the phenomenon and can easily access information about it, which is not always the case (LaMorte 2022).

3.2.3 Attribution Theory

Attribution Theory (AT) was originally developed in 1958 by Fritz Heider. It was later expanded into a theoretical framework by Weiner and colleagues in 1972. The theory focuses on how individuals understand the causes of situations, evaluate responsibility for outcomes, and relate these to the behaviour and reasoning of those involved (Krueger 2007; Palmieri and Peterson 2009). This aligns with Freid's (2020) view that theories aid in understanding phenomena by facilitating description and prediction.

According to Malle (2004), AT posits that attribution is a three-stage process. It involves the observation of behaviour, followed by assigning its cause to either internal factors (internal attribution) or external factors (external attribution). During the final stage, internal causes are categorised as dispositional attribution, while external causes are considered situational attribution (Figure 3.3; Kamarulzaman 2012).

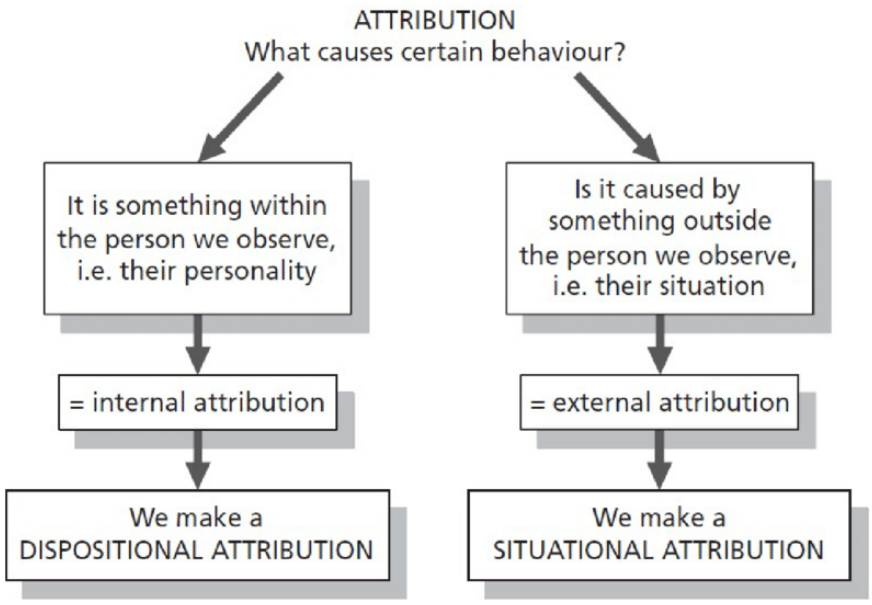

Figure 3.3: Attribution Theory (Kamarulzaman 2012).

Palmieri and Peterson (2009) highlighted that despite being widely used in management, the AT has broken ground in the healthcare field. It has contributed evidence-based insights into adverse events and other situations in clinical practice. To that end, the AT was incorporated in this study to provide insight into the experiences of frontline radiology staff during the COVID-19 pandemic. AT helped address the theoretical gap of how cultural or societal norms influence or control the perception filters of individuals prior to primary appraisal (Mcleod 2023). Furthermore, added Mcleod (2023), AT is invaluable for the researcher as it provides an understanding of the reasons for the participants' perception filters.

LaMorte (2022) highlighted that like any other theoretical framework, AT also presents challenges. These include the subjectivity involved in how events are perceived by both the participant (radiology staff) and the observer. Additionally, biases and social consensus may influence or alter the participant's perception. However, for the current study, this was addressed by the research design of choice – IPA, which allowed the researcher to focus on the participants' sense-making of their lived experience.

3.3 THEORETICAL FRAMEWORK OF THE STUDY

After exploring two models (TMSC and HBM) and one theory (AT), the researcher found that each offered a unique theoretical perspective. These perspectives enabled a more comprehensive and robust exploration of the experiences of frontline radiology staff based in the eThekwini district during the COVID-19 pandemic. Therefore, a triangulated theoretical framework (modified Transactional Model of Stress and Coping, incorporating Health Belief Model HBM and Attribution Theory) was identified as the most suitable for the study. It was selected to effectively address the research problem and guide the study, as detailed in the following discussion.

3.3.1 Modified TMSC, incorporating HBM and AT framework

Presented in diagrammatic form (Figure 3.4), the theoretical framework of this study enables visualisation of the relationships between the various concepts central to the study. This framework was developed by integrating concepts from the Transactional Model of Stress and Coping (TMSC), the Health Belief Model (HBM) and Attribution Theory (AT). Each model or theory's concepts (illustrated in Figures 3.1, 3.2, and 3.3) were thoroughly analysed to identify potential connections that could provide insight into the phenomenon under investigation. Concepts from the two models and the theory that were not applicable to the study were excluded, while those relevant to the current research were connected to demonstrate their interrelationships. (Miles, Huberman, and Saldaña 2014). Furthermore, the framework aligns these relationships with the study's problem, aim and research questions (McGaghie, Bordage, and Shea 2001).

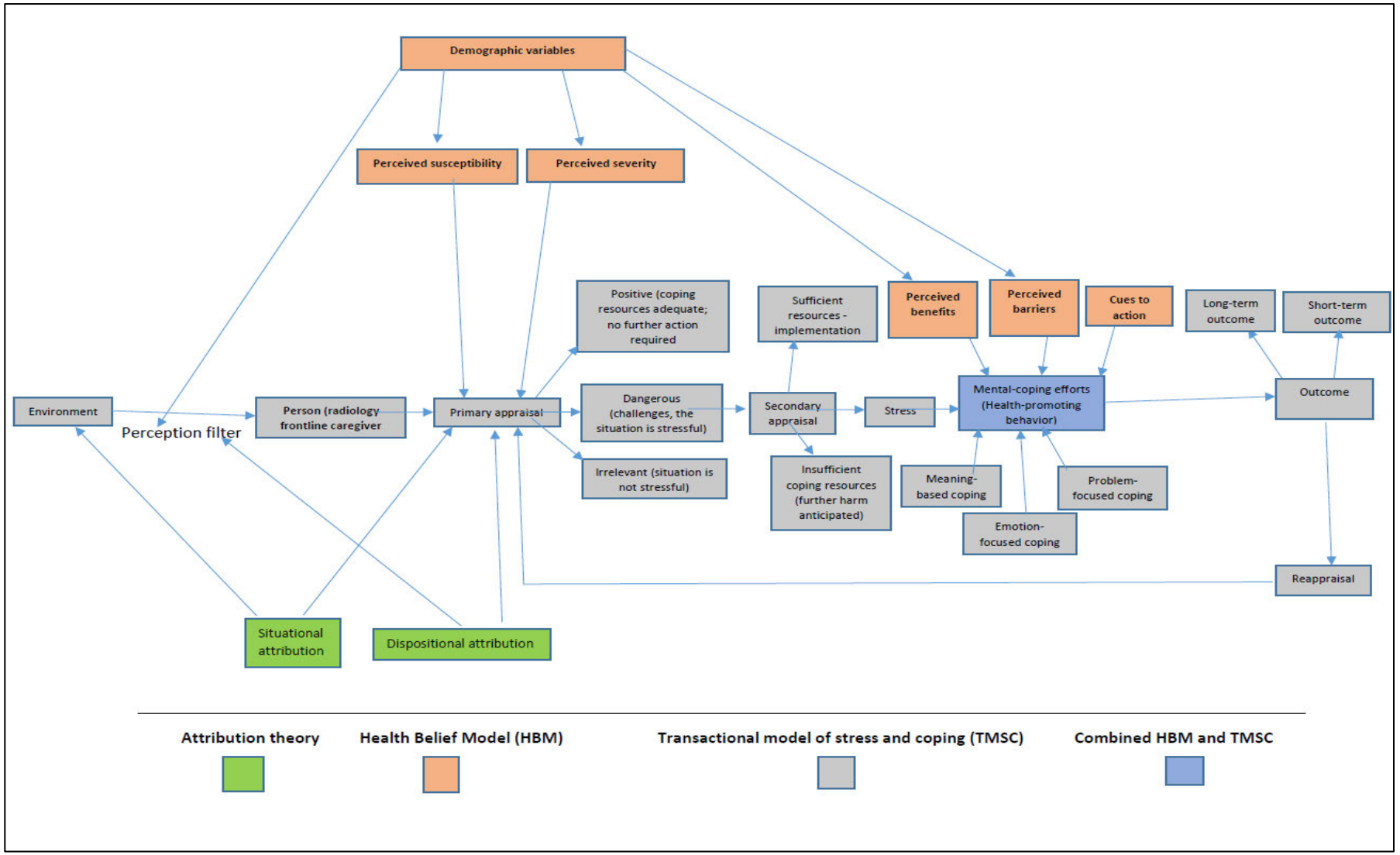

Figure 3.4: Theoretical framework of the study

3.3.2 Applying the modified TMSC, incorporating HBM and AT Framework to the study

The modified TMSC, incorporating HBM and AT framework, provides a comprehensive understanding of the mental health and coping experiences of frontline radiology staff during the COVID-19 pandemic. This framework illustrates how the interaction between the individual and their environment (stressors such as the pandemic) is shaped by cognitive, perceptual, and behavioural processes. These processes operate at various stages and ultimately influence outcomes related to mental health and well-being. The framework enables a holistic understanding of radiology staff experiences by integrating personal perceptions, external attributions and coping mechanisms. Specifically:

- Perception filter: The process begins with how frontline radiology staff perceive their environment, the stressors they face, and their personal susceptibility. These perceptions are influenced by factors such as demographic variables, the perceived severity of the situation, and the level of exposure risk (e.g., working with COVID-19 patients).
- Stress appraisal: Guided by the TMSC, staff evaluate situations through a primary appraisal to determine whether they are irrelevant, positive, or dangerous (stressful). If a situation is deemed stressful, a secondary appraisal assesses the adequacy of available coping resources. This process directs the individual toward different coping mechanisms, including problem-focused coping, emotion-focused coping or meaning-based coping (Lazarus and Folkman 1984).
- Health behaviours: Drawing from the HBM, the framework assesses how staff adopt health-promoting behaviours, such as consistently wearing PPE or adhering to safety protocols. These actions are influenced by perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action from the workplace or external environment.

- Attribution processes: The AT introduces the role of situational attribution (external stressors such as institutional workload) and dispositional attribution (internal factors such as resilience), shaping how frontline radiology staff perceive and respond to challenges.
- Outcome assessment: The combined processes lead to short-term outcomes (e.g., immediate mental strain) and long-term outcomes (e.g., mental well-being and sustained professional competence). Reappraisal processes further refine staff coping mechanisms over time.

By synthesising these concepts, the framework provides a robust structure for analysing how frontline radiology staff navigate challenges, manage stress, and adopt coping mechanisms during a health crisis. It highlights the dynamic interaction between perceptions, coping strategies, and outcomes. These interactions offer actionable insights for developing targeted interventions that support the mental health and well-being of frontline radiology staff.

3.4 SUMMARY OF THE CHAPTER

This chapter has outlined the theoretical framework - modified TMSC, incorporating HBM and AT, which provides the foundation for this study and offers a deeper understanding of the research problem. To comprehensively explore the mental health and well-being experiences of radiology staff during the COVID-19 pandemic, concepts from the Health Belief Model and Attribution Theory were integrated with the Transactional Model of Stress and Coping. This integration resulted in the development of a triangulated theoretical framework that identifies the key concepts of the study and their interrelationships, thereby guiding the researcher in planning the study. The findings of this study will revisit this framework in the discussion chapter to compare the data with the framework. Moreover, recommendations arising from the study's findings will also incorporate this framework to provide comprehensive recommendations in Chapter 7.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 INTRODUCTION

As Maxwell (2013) asserted, the methodology of a research study is not a standalone section, but rather a cohesive and integrated component that interacts with all other parts of the study. This interconnected structure ensures that the research is flexible and the methods are aligned with the study's aim, research questions and frameworks (Figure 4.1). Having established the focus of the study in the preceding chapters, this chapter details the methods employed by the researcher to collect and analyse data necessary to address the study's aim. The chapter begins by clearly articulating the researcher's philosophical position, which has shaped both the methodology and methods used throughout the research. The research setting, data collection and analysis techniques, methods for ensuring the study's trustworthiness, and ethical considerations are also outlined.

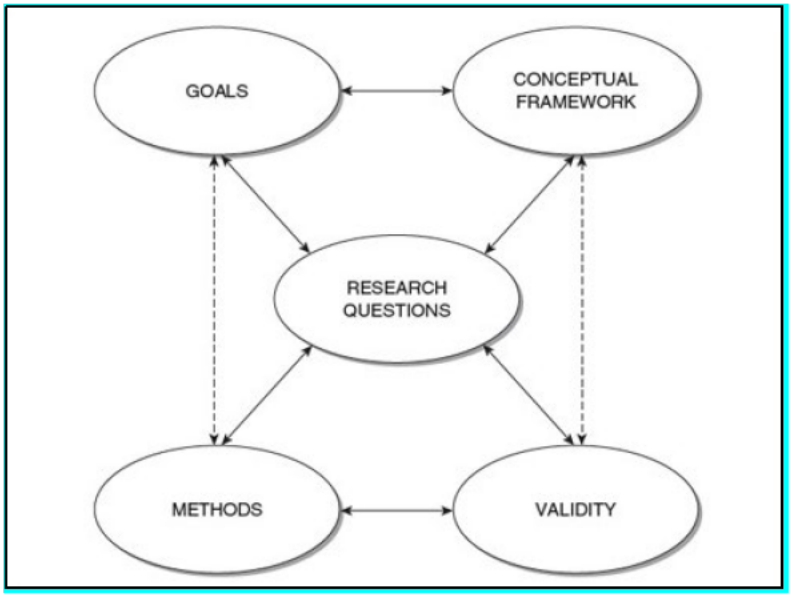

Figure 4.1: An interactive model of research design (Maxwell 2013).

4.2 RESEARCH PARADIGM, PHILOSOPHICAL ASSUMPTIONS AND RESEARCHER'S POSITION

Patel (2015) highlighted that improvements and the increase in health science research have necessitated ensuring methodological rigour as this has a significant influence on the validity and reliability of the study's results. At the pivot of determining this rigour are paradigms also known as theoretical perspectives or philosophical epochs. Defined as a shared understanding among scientists about how to interpret and solve problems, paradigms provide a philosophical underpinning for a study's research approach (Creswell 2014). Authors have indicated that researchers approach their studies better when using paradigms (Patel 2015).

According to Patel (2015), research paradigms serve two primary purposes: guiding how research problems are addressed and influencing the researcher's choice of methodology. Patton (2002) and Patel (2015) further explained that theoretical perspectives, or the 'lens through which a researcher looks,' are rooted in the philosophical fields of ontology and epistemology. Hay (2002) and Crotty (1998) highlight the strong interconnection between the three aspects of research philosophy - ontology, epistemology, and theoretical perspectives - and a study's methodology, methods, and data sources. This relationship is further clarified through the researcher's philosophical position, discussed in the following section.

Aligned with Wisker's (2019) perspective, the researcher acknowledges that the study is shaped by the researcher's own worldview. Specifically, this refers to the researcher's understanding of how knowledge is constructed or discovered. This understanding influences the approach to interpreting data in response to the research questions. The researcher's philosophical assumptions are rooted in the social constructivist paradigm. This position is guided by the considerations outlined above and informed by the researcher's understanding of current literature and the theoretical perspectives relevant to the study's topic. Originating in the

19th century through the ideas of philosophers Wilhelm Dilthey, Edmund Husserl, and Max Weber, constructivism is grounded in an ontological position that views reality as relative, multifaceted, and not governed by fixed natural laws (Given 2008).

As a social constructivist researcher, the researcher acknowledges the deeply personal connection to this study and recognises how their philosophical stance shapes its design and execution. Their experiences as a healthcare worker in the radiology department during the COVID-19 pandemic formed a critical lens through which they view the world and interpret knowledge. Being on the 'frontline battlefield' as the pandemic unfolded in South Africa provided the researcher with first-hand insight into the physical and emotional toll experienced by healthcare professionals, especially radiology staff. These experiences are not merely background influences but central motivators that informed the choice of research topic and approach.

The researcher's philosophical position and assumptions aligned with this study comprise ontological, epistemological, axiological, and methodological assumptions, which are expanded on in subsequent paragraphs.

Ontology refers to the philosophical study of the nature of reality, encompassing the entities and categories that exist within it (Crotty, 1998; Patel, 2015). As articulated by Guba and Lincoln (1994), ontological assumptions explore the 'way things are,' the 'nature of reality,' and what constitutes 'real' existence and action. Grounded in a social constructivist paradigm, the researcher holds the view that reality is socially constructed, subjective, and therefore varies across individuals, contexts, spaces, and times, and is hence not generalisable (Chilisa and Kawulich 201). In this study, each radiology staff member offers a unique interpretation of the COVID-19 pandemic and their lived experiences of it. Furthermore, these accounts are contextually situated within the pandemic as it unfolded in their

respective departments and areas of practice, specifically within the eThekwini district of South Africa. Moreover, these individual experiences were also shaped by their specific cultural perspectives and personal interpretations.

Social constructivism also recognises that human experiences evolve and are therefore shaped by the specific context and various influencing factors (Wisker 2009). In the context of the current study, this perspective highlights the dynamic and contextual nature of radiology staff's experiences during the COVID-19 pandemic. Their perceptions and responses are not fixed but influenced by changing circumstances within their work environments, personal lives and the broader societal impact of the health crisis.

Epistemologically, in line with the researcher's social constructivist position, knowledge is considered subjective and socially constructed. This aligns with Neimeyer and Levitt's (2001) view that knowledge is shaped through the subjective interpretation of individuals' experiences of a phenomenon, in this case, the lived experience of COVID-19. Consequently, in this study, knowledge will differ across radiology staff, influenced by their mental state, cultural perspectives, experiences and personal beliefs (Chilisa and Kawulich 2012). Moreover, the researcher holds the view that knowledge is developed through interaction with the participants. Hence, in this study, knowledge of the radiology staff's mental health and well-being experiences during the COVID-19 pandemic emerges from their lived experiences and understood through their narratives. Therefore, due to these alluded reasons, this study assumes it is imperative to explore radiology staff's personal narratives to understand the phenomenon.

The researcher's social constructivist stance assumes that reality is socially constructed, subjective, and context-dependent (Chilisa and Kawulich 2012). In this light, the lived experiences of radiology staff are seen as diverse and shaped by individual contexts, perceptions, and the specific challenges they faced during

the pandemic. This belief guided the researcher's use of a phenomenological approach, which prioritises the subjective realities of participants and seeks to uncover their unique interpretations of the phenomenon under study. In line with Patel (2015) and Moon and Blackman (2017), these multiple and socially constructed realities imply that the researcher can understand the radiology staff's individual realities by exploring each individual's experience of the COVID-19 pandemic. Hence, this involves understanding and making meaning of the participants' realities about COVID-19, which are subjective and influenced by each participant's history and social perspective (Moon and Blackman 2014).

However, the researcher is critically aware that their values, personal experiences, and emotional proximity to the topic may influence various aspects of the research process. For instance, the researcher's own mental and emotional journey during the pandemic may affect how research questions are framed, how participants are engaged, and how findings are interpreted. To mitigate these influences, reflexive practice was employed throughout the study, involving an examination of how the researcher's positionality might shape or bias the research. This reflexivity included the current philosophical reflexivity, personal reflexivity explored in subsequent chapters, and a balancing of subjectivity throughout the study, thereby ensuring the integrity and trustworthiness of the research (Creswell 2014).

The researcher's positionality brings a distinct perspective to this study, enhancing it with contextual sensitivity in understanding the experiences of radiology staff during the unprecedented COVID-19 pandemic within the eThekwini district, where the researcher was based at the beginning of the study. According to the researcher's axiological assumptions, through reflexivity, it is acknowledged that the value-laden nature of the research means that the researcher's perspectives, beliefs, and values could potentially influence the study's research methods and conclusions (Chilisa and Kawulich 2012).

4.3 RESEARCH DESIGN

A research methodology is one of the most important choices that a researcher should make early in the research process. This choice is crucial for answering the research questions validly (Asenahabi 2019). Haenssgen (2020) described it as the glue that joins the aim, research questions, data collection, sampling, and data analysis of the study. Social constructivists rely heavily on constructing knowledge in social contexts (Chilisa and Kawulich 2012). This requires a methodology that is flexible, context-sensitive, and more concerned with depth of personal accounts than with the generalisability of narratives (Given 2008). Therefore, a qualitative methodology was employed.

Defined by Creswell and Creswell (2018) as an approach for exploring and understanding the individual's interpretation of a social or human problem, the qualitative methodology was found fit for this study as it enables the understanding of:

- meanings and perspectives of the study population – seeing the world from their point of view and not the researcher's.
- how these perspectives are influenced by physical, social, and cultural contexts.
- how these perspectives shape the study population's physical, social, and cultural contexts.
- the particular processes that are involved in maintaining or altering the phenomena under study (Maxwell 2013).

The characteristics of qualitative research which include an open-ended approach and reliance on textual data rather than numerical data (Maxwell 2013), allowed the researcher to explore the experiences of frontline radiology staff during the COVID-19 pandemic in great detail through personal narratives of their experiences.

4.3.1 Interpretative Phenomenological Analysis

In keeping with the researcher's philosophical stance and assumptions, Interpretative Phenomenological Analysis (IPA) was found to be the most appropriate for this study. IPA is described by Smith, Flowers and Larkin (2022) as a qualitative research approach. It aims to explore an individual's lived experience of a phenomenon of great significance in their life. Originating in the field of Psychology, IPA has extended its use to healthcare research, where it currently occupies a significant position. IPA was utilised to allow for critical assessment and interpretation of the mental health and well-being experiences of frontline radiology staff during the COVID-19 pandemic. This was achieved through intensive dialogue with the participants (Smith, Flowers, and Larkin 2009). The COVID-19 pandemic was a healthcare catastrophe. It brought swift changes that potentially left significant marks on individuals' lives as they were either infected or affected by the pandemic and its impacts (Sekyere *et al*. 2020). Hence, being at the pivot of this worldwide health disaster, frontline radiology staff experienced the pandemic. Each individual did so in their own unique way, which the researcher intended to explore.

Smith, Flowers and Larkin (2022) added that IPA is grounded on three theoretical axes namely:

- Phenomenology
- Hermeneutics
- Idiography

IPA is grounded in philosopher Edmund Husserl's famous advice to go *'back to the things themselves.'* This approach involves understanding the phenomenon through the individual's experience and how they make sense of it. Phenomenology, therefore, focuses on capturing the individual's reflections on the significance of what occurred, which constitutes the phenomenon (Smith, Flowers,

and Larkin 2022). In this study, this means exploring how radiology staff felt while working on the frontlines during the COVID-19 pandemic.

Beginning his philosophical career as Edmund Husserl's Phenomenology student, Martin Heidegger took phenomenology to an advanced level by developing the Theory of Interpretation – Hermeneutics (Smith, Flowers and Larkin 2022). Dan (2003) indicated that Heidegger believed that exploring an individual's lived experience was incomplete without capturing their sense-making of the experience, also known as interpretation. Thus, for this study, in addition to questioning the frontline radiology staff's reflections, thinking and feelings during the COVID-19 pandemic, the researcher also explored how they interpreted what was happening.

Additionally, Brocki and Wearden (2006) emphasised that IPA has an idiographic focus, implying that findings cannot be generalised as each lived experience is unique. IPA aims to explore *'how a given person, in a given context, makes sense of a given situation'* (Brocki and Wearden 2006). Therefore, the findings from the current study will be unique to the frontline radiology staff in the eThekwini district and as such, the resultant recommendations will be specific to this population and its circumstances.

4.4 RESEARCH SETTING

Research setting is defined by Fonseca (2023) as the physical, social or experimental context in which a study is conducted. The research setting plays a significant role in a research study as it potentially impacts the research findings. Creswell (2014) highlighted that qualitative studies involve an in-depth investigation of small samples. Therefore, this study was conducted in the eThekwini district to allow the researcher to critically explore the diverse experiences of the frontline radiology staff in various radiological care settings.

4.4.1 Geographical location of the population

The South African healthcare system is a two-sector system comprising private healthcare institutions which are privately funded and public or government healthcare institutions (Modisakeng *et al.* 2020). The NDoH has overall responsibility for healthcare in South Africa and all health-related laws and acts of parliaments such as the National Health Act 2003 (Modisakeng *et al.* 2020; Wishnia and Goudge 2020). The South African healthcare system is decentralised, giving provincial agencies independence over allocation of funds (Wishnia and Goudge 2020). The population under study is located within the eThekwini district of KZN province (Figure 4.2).

Figure 4.2: KwaZulu-Natal health districts (Ehlers *et al.* 2021).

The structure of public healthcare delivery within the eThekwini district includes a range of facilities. These comprise central hospitals such as Inkosi Albert Luthuli Central Hospital, which offers subspeciality and speciality healthcare services. Other facilities include King Edward VIII Hospital, a tertiary and regional hospital; Addington, King Dinizulu, Prince Mshiyeni Memorial, and RK Khan Hospitals, which are classified as regional hospitals. Additionally, the district includes district-level hospitals and community health centres such as Phoenix and KwaMashu Health Centres (KZN Health 2023). These facilities were all included in the study. The private healthcare system, which is run independently of government funding, is available within the different parts of the eThekwini district and caters for self-funded individuals (KZN Transport 2023). The following were included for this study: Lake, Smit and Partners Incorporated and Jackpersad and Partners Incorporated.

4.4.2 Data collection setting

In accordance with Smith, Flowers, and Larkin (2022), participants in the current study were allowed to choose their preferred interview platform (online or telephonic) due to the pandemic. The researcher advised participants to be in their preferred physical space during the interviews and focus group discussions (FGDs). This ensured they were in a comfortably familiar setting that was quiet enough to provide the privacy needed for opening up and sharing their lived experiences (Smith, Flowers, and Larkin 2022).

For convenience, most participants opted for the WhatsApp option. This was because they were usually involved in demanding work shifts, and some faced internet connection challenges within their departments. Additionally, due to the nature of their work, most participants were not very familiar with Zoom or Microsoft Teams. Instead, they preferred WhatsApp, which was within their comfort zone. The interviews were conducted telephonically or online (Zoom). The FGDs were conducted through video calls on WhatsApp.

4.5 SAMPLING PROCESS

The population under study was the Health Professions Council of South Africa (HPCSA) and the South African Nursing Council (SANC) registered frontline radiology staff working in private and public eThekwini radiology departments. The target population comprised the HPCSA and SANC registered frontline radiology staff who are currently practising in the eThekwini district, in either the public or private sector. The accessible population for this study was the frontline radiology staff who were available for interviews and FGDs. The study comprised only radiology-based frontline staff working in the eThekwini district to ensure homogeneity in the sample (Pietkiewics and Smith 2014).

4.5.1 Sampling technique and sample size

The study population consisted of frontline radiology staff from various working sectors and professional categories. Therefore, the maximum variation purposive sampling method was adopted to ensure participant diversity. This method also increased the potential for obtaining greater insight into the phenomena under investigation (Johnson and Christensen 2014). Maximum variation purposive sampling, also known as heterogeneous sampling, allowed for capturing a wider range of perspectives. It facilitated understanding the lived experiences of the COVID-19 pandemic among frontline radiology staff (Vijayamohan 2023).

The population was initially categorised into their working sectors (private and public sectors) and further into professional categories (nurses, radiographers, and radiologists) as illustrated in Figure 4.3.

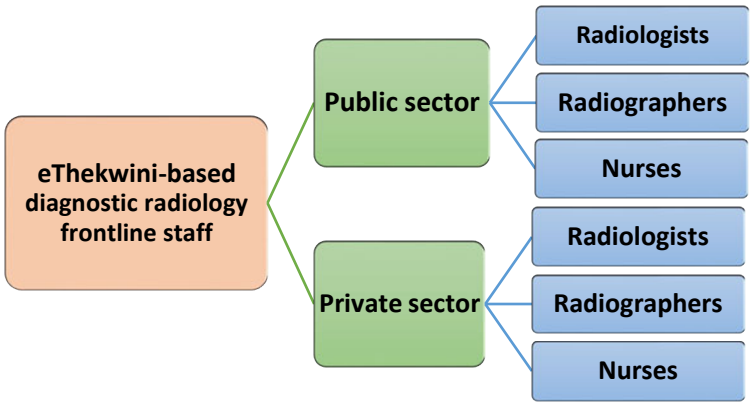

Figure 4.3: Categorisation of eThekwini frontline radiology staff

Phases 1 and 2: Equal numbers of participants were recruited from the private and public sector health facilities across three professional categories: radiologists, radiographers, and nurses. The sample size was determined based on data saturation within each professional category, following these parameters:

Phase 1: A minimum of four and a maximum of six participants from each category were interviewed. This aligns with the principles of phenomenological studies, which are most effective with a maximum of 15 participants (Pietkiewicz and Smith, 2014). According to Pietkiewicz and Smith (2014), this sample size enables detailed exploration and analysis of the phenomenon.

Phase 2: A minimum of five and a maximum of eight participants were recruited for each of the two focus groups. This aligns with Nyumba *et al.* (2018)'s recommendation that focus groups are effective with a minimum of four and a maximum of 12 participants. The first focus group consisted of radiographers from the private sector. The second focus group included radiographers from the public sector. This approach ensured homogeneity within each group.

4.5.2 Inclusion criteria for the sample

The inclusion criteria comprised:

- HPCSA or SANC registered frontline radiology staff working in either private or public eThekwini radiology departments.
- Radiologists, radiographers and nurses based in the radiology department.
- Frontline radiology staff with at least two years of service at their respective hospitals before the date of data collection.
- Any races and genders.

4.5.3 Exclusion criteria for the sample

The exclusion criteria comprised:

- Trainees, student radiographers, and rotating registrars. These staff members were excluded from the study, as their lived experiences may have been influenced by external factors unrelated to the radiology department.
- Radiology staff who were not working in facilities attending to COVID-19-related cases.

It was important to balance the homogeneity and heterogeneity of the sample. This allowed for a deeper exploration of the radiology staff's mental health experiences within the eThekwini district context. At the same time, it enabled the capture of diverse lived experiences based on participants' varying characteristics. In line with Robinson (2013), explicit inclusion and exclusion criteria ensured overall homogeneity in the sample. The study included only frontline radiology staff working in the eThekwini district of South Africa. This enabled a homogeneous sample, facilitating a deeper exploration of participants' experiences within a geographically defined group. The approach also ensured focus and relevance (Pietkiewicz and Smith 2014). It aligned with the study's Interpretative Phenomenological Analysis methodology, which emphasises homogeneity for contextualising findings to a localised sample (Smith, Flowers and Larkin 2009).

The sample's heterogeneity was based on its demographic diversity. This included variations in age, profession (radiographer, radiologist, or nurse), working sector (private or public), and professional levels or grades (grades 1-3, managers, chief radiographers, and chief supervisory radiographers). This heterogeneity enabled the identification of variations, outliers, or contrasting experiences within the population.

4.6 PRE-TESTING OF THE DATA COLLECTION TOOLS

An interview guide (Appendix 7) and a focus group discussion guide (Appendix 8) were used to collect data during phase 1 (one-on-one interviews) and phase 2 (focus group discussions), respectively. Both phases employed semi-structured methods, offering a balance between structure and flexibility. This approach provided a predefined outline of topics to be addressed while allowing spontaneous adaptation of interviews or focus group discussions (FGDs) to delve deeper into emerging themes during the conversation (Haenssgen 2020). Pietkiewicz and Smith (2014) emphasised the value of semi-structured interviews, noting that they foster real-time dialogue between the researcher and participants. This interaction creates space for unanticipated and original issues to surface, which the researcher can explore further through follow-up questions, enriching the depth and breadth of the data collected. The research study's problem and objectives were interlinked with the theoretical framework to formulate the data collection tools (Appendices B and C) as outlined in Table 4.1.

Both the interview guide and the focus group discussion guide included questions that explored participants' knowledge of their professional roles in relation to COVID-19. They also examined participants' perceived challenges, their experiences, the perceived influence of COVID-19, and its consequences on their mental well-being. Furthermore, the perceived influence of the resultant mental health status on their professional competence and mental health-coping mechanisms was investigated.

Table 4.1: Formulation of data collection focus areas

Model or Theory	Concept	Category	Data collection focus area
Transactional Model of Stress and Coping	Environment stimuli	Stressor	• COVID-19 and consequences.
	Perception filter	Modifying factors	• Participants' demographical data. • Knowledge about duties and roles with regards to COVID-19 (infection prevention and control; radiology; patient care).
	Primary appraisal (interpretation of stressors)	Perceived challenges	• Personal challenges. • Work-related challenges.
		Perceived experiences	• Emotional experiences. • Psychological experiences.
		Perceived influence	• Perceived influence of COVID-19 and consequences on mental well-being. • Perceived influence of the resultant mental health status on professional competence.
	Secondary appraisal (analysis of available coping resources)	Mental-coping mechanisms	• Mental coping mechanisms known to the participants.
	Coping (overcoming of stress)	Personal mental-coping mechanisms	• Emotion-focused coping mechanisms. • Problem-focused mechanisms. • Meaning-based coping mechanisms.
	Outcome (assessment of the effect of implemented coping mechanisms)	Short term and long-term outcomes	• Individual outcomes. • Work-related outcomes.
Health Belief Model	Demographic variables	Modifying variables	• Participants' demographical data.
	Perceived severity and susceptibility.	Perceived beliefs of susceptibility and severity of influence	• Perceived influence of COVID-19 and consequences on mental well-being. • Perceived influence of the resultant mental health status on professional competence.
	Perceived benefits	Perceived benefits of mental-coping mechanisms	• Personal benefits. • Work-related benefits.
	Perceived barriers	Perceived barriers to mental-coping efforts	• Individual barriers. • Work-related barriers.
	Cues to action	External influences prompting mental-coping	• Availability of health-behaviour promoting services. ❖ Mental-coping education-workshops, media, colleagues and family. ❖ Stress symptoms.
Attribution Theory	Dispositional attribution	Perceived internal causality	• Perceived personal challenges. • Perceived emotional and psychological experiences. • Perceived influence of the resultant mental health status on the individual's professional competence • Perceived individual barriers to mental-coping efforts.
	Situational attribution	Perceived external causality	• Perceived influence of COVID-19 and consequences on mental well-being. • Work-related barriers to mental-coping efforts.

4.6.1 Pilot study

After ethics approval and gatekeeper permissions were granted, a pilot study was conducted to pre-test the interview. This involved participants who were not part of the final data collection sample, in order to avoid pre-exposure to the questions. This pre-test helped the researcher identify any unforeseen challenges; test the feasibility of the study and the ability of the interview to provide answers to the research questions (Creswell 2014). Additionally, this allowed the researcher to familiarise themself with the interview guide (Appendix 7) (Creswell 2014).

Three individuals from each profession; nursing, radiography and radiology took part in the pilot study. All the participants indicated a good understanding of the interview guide; hence, no changes were made to the interview guide following the pilot study.

4.7 DATA COLLECTION PROCESS

A cross-sectional approach also referred to as a 'snapshot' collection of data Haenssgen (2020) was chosen. Hence, data was collected one-off between May and October 2021. The study was conducted in an interview-focus group hybrid fashion consisting of two phases as illustrated in Figure 4.4. Phases 1 and 2 were conducted consecutively between May and September 2021. During Phase 1, one-on-one interviews were used to encourage participants to share personal accounts. In Phase 2, focus group discussions provided a safe platform for participants to openly express work-related issues without fear of victimisation. Data collected in each phase was analysed within the same phase. This multi-method approach enabled the validation of concepts and ideas (Bauer and Gasket 2000; Lambert and Loiselle 2008).

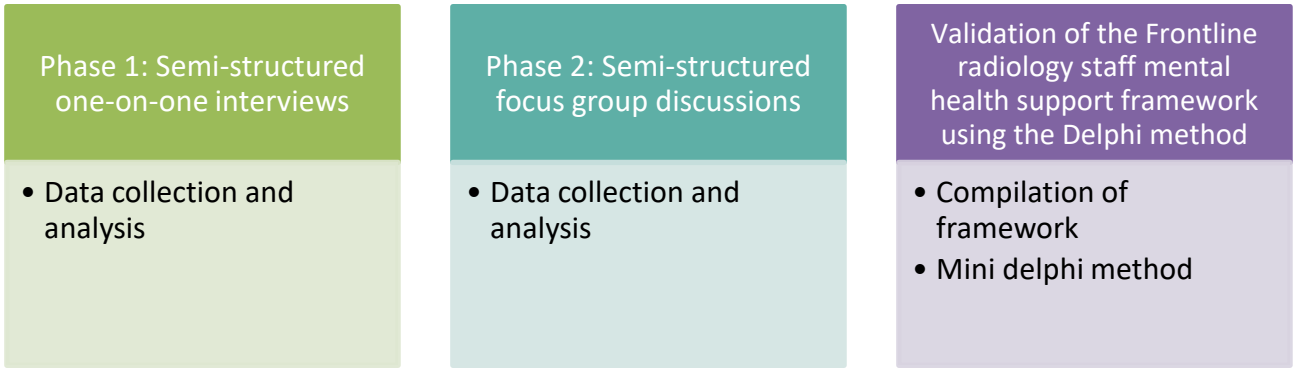

Figure 4.4: Data collection process outline

4.7.1 Phases 1 and 2: Semi-structured one-on-one interviews and focus group discussions

During phase one, data was collected through semi-structured, one-on-one interviews. These interviews have a higher probability of providing reliable and comparable qualitative data (Creswell 2014). Phase two of data collection was conducted independently. It involved semi-structured focus groups because some participants preferred to express their views and share work challenges collectively, rather than individually. This preference is often due to fear of victimisation when discussing sensitive work-related topics (Bauer and Gaskell 2000). Additionally, gathering a collective perspective enabled the synthesis and validation of ideas and concepts (Bauer and Gaskell 2000).

Interview invitations, along with an attached letter of information (Appendix 5) summarising the study and its objectives, were emailed to all heads of radiology departments. These invitations were intended for circulation among their staff. Prospective participants were required to complete a consent form (Appendix 6) and a demographics questionnaire (Appendix 7 Section A; Appendix 8 Section A). Afterwards, arrangements were made with the researcher to conduct in-depth semi-structured telephonic interviews and online-video focus groups. These arrangements adhered to COVID-19 regulations. Participants were also provided

with a form (Appendix 9) to select their preferred interview platform, either online or telephonic. The interviews and focus group discussions occurred at a time convenient for the participants. These were usually scheduled during lunch breaks or in the evening when participants were at home.

At the beginning of either the interview or FGD, the researcher reiterated the aims and purpose of the study. The researcher also went over the contents of the letter of information with the participants. They were reassured that their identity would be protected and that confidentiality would be maintained throughout the study. The researcher obtained individual consent from participants to record the interview. Participants were further reassured that their anonymity would be ensured.

The researcher provided guidance on how the session would run and explained the house-keeping rules. Participants were advised to speak audibly to ensure that their responses were clearly recorded. The researcher also explained that their role would be as a passive facilitator. Participants were encouraged to elaborate on their answers to provide more in-depth explanations and insights. Any probing questions following participants' responses were used to facilitate the discussions (Smith, Flowers, and Larkin 2022).

Data analysis for phases 1 and 2 is outlined in section 4.8.

4.7.2 Framework validation with Delphi method

A Delphi survey was conducted to validate the developed mental health coping framework among frontline radiology staff. Originating in the USA in the 1950s, the Delphi method was developed by the Rand Corporation to predict the impact of technology on warfare (Mulder 2017). However, it has been modified over the years to allow its application in various disciplines (Grime and Wright 2016). Defined by Grime and Wright (2016) as a forecasting technique, the Delphi

technique involves several rounds of surveys among experts until a group consensus is reached (Mulder 2017).

For this study, a group of 10 radiology experts critically reviewed the developed framework to ensure it was validated, relatable to the target population, and aligned with expert opinions in the field. Participants were purposively selected based on their experience. The group comprised eight PhD holders who are experts in research, teaching, and learning, and two radiography managers based in eThekwini, one of whom also holds a PhD qualification. Among the academics, two were from international locations, while six were affiliated with South African universities, providing diverse perspectives and enriching the analysis. Additionally, most participants had over seven years of clinical experience within Radiology departments, enabling a balanced evaluation of both the theoretical and clinical applications of the proposed framework.

Invitations were sent out via email with a copy of a letter of information for the Delphi participants (Appendix 11). Upon agreeing to take part in the Delphi survey, participants were provided with a consent form for Delphi participants (Appendix 12). This was to be completed prior to the survey. Due to the numerous questions around the framework, the researcher organised a 30-minute-long session to present the framework to the participants. The framework was evaluated using the Delphi survey evaluation form (Appendix 13). The form was adapted from Chinn and Kramer's (2018) theory evaluation criteria by rephrasing the criteria as questions 4-8. The evaluation involved validation of the concepts, relationships between concepts and the suitability of the framework for adoption within both public and private radiology departments. Opinions and comments on the framework were analysed and opened for further comments. Therefore, the refined version of the framework was benchmarked against existing literature and reviewed by radiology experts. The aim was to ensure it effectively supports mental health coping among frontline radiology staff during health crises.

4.8 DATA ANALYSIS

The collected data was interpreted and analysed manually through the use of the IPA Framework. This allowed the researcher to engross in the data and *'step into the participants' shoes as far as possible'* (Pietkiewics and Smith 2014). This allowed the simultaneous gathering of evidence of the frontline radiology staff's sense-making of their experiences during the COVID-19 pandemic and the researcher's sense-making of the phenomena – double Hermeneutics (Pietkiewics and Smith 2014). The following steps (Figure 4.5) were incorporated to allow a detailed case-by-case analysis of the interviews (Phase 1) and focus group discussions (Phase 2).

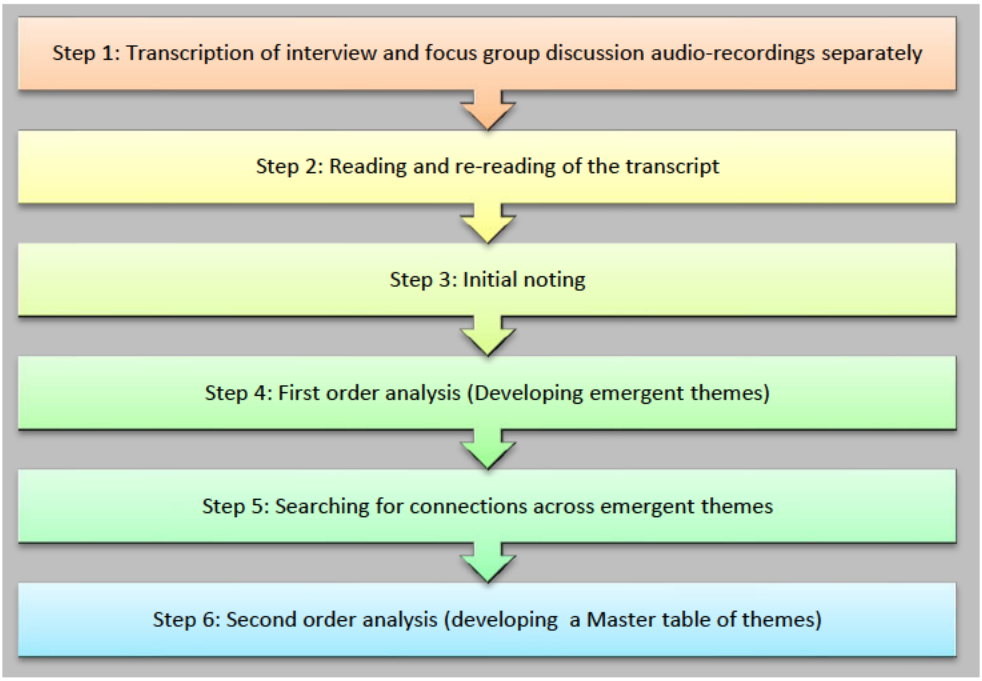

Figure 4.5: IPA Framework (Smith, Flowers and Larkin 2009).

As illustrated in Figure 4.5, the audio-recordings of the interviews and focus group discussions were initially analysed as single cases (Steps 1-5). This involved transcription of the audio-recordings into written scripts. Due to the extended

duration of the data collection sessions, since this was a topic that was very close to the participants' hearts, the researcher sought external assistance from a professional transcriber. After this, the researcher verified all the transcripts with the recordings to ensure that they had been transcribed correctly.

The second step involved reading and re-reading the interview transcripts for better understanding (Smith and Osborn 2007). The researcher made use of the reflective log (Appendix 10) to capture any thoughts that came to mind while reading the transcript. This included the researcher's thoughts upon reading the script as well as their understanding of what the participant explained in response to all the questions. As the researcher became increasingly familiar with the transcripts, they were able to identify each participant's understanding, their way of speaking, and their thoughts about the phenomenon under study, which was their experience during the COVID-19 pandemic (Smith, Flowers and Larkin 2022).

An exploratory examination of semantic content and language use in the transcript was conducted during step 3 (Smith, Flowers and Larkin 2009). The researcher carried out this phase with an open mind while populating the reflective log (Appendix 10) and the transcript with anything that was found interesting within the transcript. During the first order analysis (step 4), emergent themes in the form of concise phrases aligned with the participant's account were developed from the annotated transcripts (Pietkiewics and Smith 2014). Common themes arising from step 4 were searched for connections and clustered in terms of abstraction, subsumption, polarisation, contextualisation, numeration, and function during step 5 (Smith, Flowers and Larkin 2009). Throughout these steps (1-5), the researcher ensured that individual voices and experiences were sufficiently captured for both the interviews and focus group discussions. Therefore, ensuring the idiographic focus of IPA (Smith, Flowers and Larkin 2022).

Steps 1-5 were conducted for every case (i.e each interview and focus group transcript), after which a second-order analysis also known as analysis of the analysis, was performed (Step 7). Smith and Osborn (2007) explain that the second-order analysis involves searching for patterns across the cases to formulate a Master table of themes for the sample. The findings were then presented and interpreted in a descriptive, narrative form (Uprety 2010).

4.9 TRUSTWORTHINESS

According to Cypress (2017), the quality of research is of paramount importance in both qualitative and quantitative studies, as it directly impacts the study outcomes. However, there is a far-from-conclusive debate around the precise definition and terminology of quality in qualitative research (Cypress 2017). While some scholars argue that rigour in qualitative research mirrors reliability and validity in quantitative research, other naturalistic enquirers are adamant about the use of a different criteria to describe rigour in qualitative studies (Forero *et al*. 2018). The reflexibility and repeatability of the steps of enquiry during a qualitative research highlight the need to ensure rigour or trustworthiness is incorporated throughout the study and not just ensured as a post hoc evaluation (Cypress 2017). Measures for ensuring rigour within a qualitative study should be incepted before the qualitative design is fully implemented. Thus, this implies that the researcher should plan beforehand how they will ensure trustworthiness from the planning stage until the completion of the study, explained Cypress (2017).

For the current study, rigour was ensured by incorporating the Trustworthiness framework by Guba and Lincoln, 1994 (Johnson and Christensen 2014). The Trustworthiness framework, also referred to as the Four-Dimensions Criteria (FDC) by Forero *et al*. (2018), comprises credibility, dependability, confirmability and transferability. Details of how the researcher implemented each of these dimensions in the study are outlined in the subsequent sections.

4.9.1 Credibility

Credibility seeks to establish confidence that the study findings based on the participants' perspectives are true, credible and believable (Forero *et al*. 2018). The credibility of the study was ensured by developing an interview schedule and piloting the interview. Thereby improving the researcher's interviewing and focus group facilitation skills (Johnson and Christensen 2014). The researcher also incorporated peer validation and cross-checking of the interview and focus group notes with the audio recordings (Johnson and Christensen 2014).

4.9.2 Dependability

Dependability aims to ensure that the study findings are repeatable. In other words, if the study were repeated with the same cohort of participants, coders, settings, and context, similar findings would be obtained (Forero *et al.* 2018). To establish dependability, the researcher maintained an audit trail of the entire research process. This audit trail included a research journal containing electronic documents, hardcopy materials, and audio recordings. Furthermore, a detailed account of the steps involved in the methodology is provided in the current chapter of the thesis (Johnson and Christensen 2014).

4.9.3 Confirmability

Confirmability seeks to establish the confidence that the study findings can be confirmed or corroborated by other researchers (Forero *et al*. 2018). To ensure this, the researcher adopted triangulation. Patton (1999) defined triangulation as the utilisation of multiple methods, data sources, or investigators in a qualitative study to develop a comprehensive understanding of phenomena. Overall, the researcher checked and rechecked data throughout the data collection and analysis processes. This was done to ensure that the study findings were based on the participants' accounts of their experiences and not the researcher's biases (Korstjens and Moser 2018). Originating from the laws of Trigonometry,

triangulation has secured broad use in qualitative research as a method of incorporating multiple options to confirm the data analysis and resultant findings (Denzin 2013).

For the current study, the researcher adopted investigator triangulation by incorporating an independent data analyst. The analyst reviewed the transcripts and the data analysis process to confirm the study findings (Denzin 2013). The researcher ensured confirmability of the study findings by implementing reflexivity journaling (Forero *et al*. 2018). *'Reflexivity means that researchers reflect about how their biases, values, and personal background, such as gender, history, culture, and socioeconomic status, shape their interpretations formed during a study'* (Creswell 2014).

Creswell (2014) stressed the importance of reflecting on the researcher's role in the study, as well as their personal background, culture, and experiences. These factors have the potential to shape their interpretations of the gathered data. Creswell (2014) also noted that the researcher's background influences the themes they advance and the meaning they ascribe to the collected data. Additionally, the researcher should not merely state how their experiences may introduce bias and values into the study. They must also outline how their background may actually shape the direction of the study (Creswell, 2014).

Being on the battlefield as a healthcare worker when COVID-19 hit the shores of South Africa, the researcher experienced the pandemic at a personal level. The physical and mental challenges of working in a radiology department at the beginning of the unknown pandemic pushed the researcher to explore this topic. This topic is close to the researcher's heart. However, to avoid bias in the study, the researcher incorporated bracketing as part of reflective journaling. Grove, Burns, and Gray (2013) described bracketing in qualitative research as a method where the researcher sets aside their own knowledge, experiences or assumptions

about the phenomena being studied. This included the predisposition to any pre-understanding, and acting non-judgementally throughout the data collection and data analysis process (Sorsa, Kiikkala, and Åstedt-Kurki 2015). The researcher's reflection is also evident in the philosophical assumptions section and the discussion section.

Qualitative research relies on the complete involvement of the researcher throughout the study. As an active data collector, data analyst, and reporter of findings, the researcher made sure to distance herself from the outcomes of the study. This was done to prevent any potential influence on the results (Sorsa, Kiikkala, and Åstedt-Kurki, 2015). To further ensure objectivity, an independent statistician was brought on board to confirm the data analysis process and output. Additionally, the researcher's supervisors reviewed the scripts and data analysis process to confirm the reliability of the findings.

Occurring either willingly or unwillingly, bias is defined by Pannucci and Wilkins (2010) and Simundic (2013) as a deviation from reality and truth in a study, particularly during data collection, analysis, and interpretation. Therefore, in keeping with Simundic (2013: 12), it was important for the researcher to acknowledge potential biases in this study and take all possible steps to minimise them, ensuring the confirmability of the research. To eliminate selection bias, which results from obtaining a non-representative sample (Bell-Martin and Marston 2019), the researcher used the maximum variation sampling method. The population included diverse categories such as professional groups (radiographers, radiologists, and nurses) and healthcare sectors (private and public). Therefore, this approach ensured representation of each category in the sample, as shown in Figure 4.3.

Volunteer bias affects the representativeness of a sample (Jordan *et al*. 2013). This issue was addressed in the current study by informing the population about the study's characteristics. This was done during staff meetings where the researcher introduced and invited participants, and through the participant information sheet (Appendix 5). Participants were assured that anonymity and confidentiality were central to the study, with no personal details linked to their shared accounts. They were also informed about the duration of the data collection sessions, which were within acceptable ranges (i.e., 60 minutes for interviews and 1 hour 15 minutes for focus group discussions). Data were collected virtually at times and locations chosen by the participants, ensuring their comfort and reducing concerns about contracting or transmitting COVID-19 during data collection. Additionally, maximum variation sampling ensured equal participation opportunities across all professional and sector categories. This was crucial as demographic characteristics, such as profession and sector, could potentially influence the study's findings (Jordan *et al.* 2013).

Social desirability is described as a type of bias that occurs when individuals depict themselves and their circumstances in a manner deemed favourable by societal standards, diverging from their actual experiences (Bergen and Labonté 2020). To address this, the researcher adopted Bergen and Labonté's (2020) strategies. These included ensuring that both the interviews and focus groups were conducted in the participants' preferred location with privacy. Participants were also given the choice to select a time that allowed them to access this environment. Moreover, the researcher also ensured that they were in a private space, using headphones for the virtual data collection sessions to avoid anyone from hearing or being within the same space. To ensure participants shared accurate accounts of their experiences, the researcher was respectful, informed staff about anonymity, and reiterated the study's purpose and data use at the start of interviews or focus group discussions. This helped participants feel comfortable and at ease.

The researcher acknowledged that, as a qualitative study, the research was prone to researcher bias, a common challenge in data analysis and interpretation (Florczak 2022). To minimise this, the researcher pre-emptied their own experiences and identified potential prejudices earlier in the study. This included acknowledging potential biases, personal background, philosophical assumptions and their possible influence on the study and findings, as discussed in chapters four and six (Smith and Noble 2024).

During data collection, the semi-structured format, while considered a limitation for inductive research (McIntosh and Morse 2015), ensured that data collection aligned with the study's aim and research questions rather than focusing solely on the researcher's interests. Furthermore, the data collection questions were ordered to avoid influencing participants' responses, thereby reducing question order bias (Shah 2019). Although semi-structured, the questions were phrased in simple, non-leading language to prevent leading questions and wording bias (Florczak 2022). Additionally, reflective journaling was employed through the use of a reflective log (Appendix 10). Data were analysed objectively to address possible confirmation bias (Smith and Noble 2014).

4.9.4 Transferability

Transferability aims to establish the extent to which study findings can be generalised or transferred to other contexts or settings (Forero *et al*. 2018). To achieve this, the study used maximum variation purposive sampling. This approach ensured the acknowledgement and inclusion of the heterogeneous population. It aimed to gain a greater insight into the experiences of radiologists, radiographers, and radiology nurses during the COVID-19 pandemic, as well as its influence on their mental well-being (Johnson and Christensen 2014). Furthermore, the study has been presented as a detailed research write-up (thesis) with direct quotations from the participants (chapter five) to ensure the transferability of the research findings (Creswell 2014).

4.10 ETHICAL CONSIDERATIONS

Originating from the Greek word ethos, meaning character or morality, and from the Latin synonym meaning manner, ethics forms an integral part of research. It seeks to systematise, defend, and recommend concepts of right and wrong behaviour (Chima 2011; Naaman *et al.* 2015). Chima (2011) added that ethics can therefore be summarised as the moral philosophical analysis of normative behaviour as it governs the 'shoulds' and 'oughts' and the 'rights' and 'wrongs' of human conduct.

Ethics plays a significant role in research which is forever ongoing as evidence-based research is required to inform human practice. There is a need to ensure that humans are not abused or exposed to any harm during such processes (Mandal, Acharya and Parija 2011). The four basic principles of ethics – autonomy, beneficence, justice and non-maleficence were developed by Tom Beauchamp and James Childress (Spencer 2015). The subsequent sections elaborate on these principles and outline how they were incorporated into the current study.

4.10.1 Autonomy

Defined by Taylor (2017) as the respect for and allowance of self-governance among participants, autonomy emphasises the need for participants to make their own independent decisions without being coerced. Following the discovery of inhumane practices in research at the Nuremberg trials that exposed the deaths of thousands due to horrific experiments, the Nuremberg Code of 1947 (The Nuremberg (TN) 1947) was developed. The code stressed the importance of obtaining informed consent from the research participants prior to conducting the study (TN 1947).

In the spirit of this code, a letter of information (Appendix 5) summarising the study and its objectives was circulated among prospective participants. The letter also informed the participants about the voluntary nature of their involvement, the non-availability of financial benefits, and assured them that confidentiality and anonymity would be prioritised. Following this, informed consent (Appendix 6) was obtained from each participant before the interviews and FGDs. Furthermore, participants had the right to ask questions or withdraw at any time if they were uncomfortable with the study.

4.10.2 Beneficence

Despite the establishment of the Nuremberg Code, reports of ill treatment of humans continued, resulting in development of international guidelines by the World Medical Association in 1964, known as the Declaration of Helsinki (World Medical Association 2013). Beneficence was defined by Kinsinger (2009) as the act of doing good. In research, this translates to the researchers ensuring that the outcome of the study will benefit the population under study, which in this case was the frontline radiology staff. To protect the rights and dignity of the participants, the researcher abided by the principles of the Helsinki declaration (Wisker 2008; WMA 2013). This included the registration of the research proposal on the National Health Research (NHR) database to formally receive gatekeeper permission from the KZN Department of Health (Appendix 1b). Following Institutional Research Ethics Committee (IREC) approval (Appendix 1a), the study was approved by the managers of the hospitals or community health centres (Appendix 4b), Health District Manager (Appendix 2b) as well as the Hospital Heads of Departments (Appendix 3b). Furthermore, the study findings have been published in an approved journal. They will also be made available through the DUT research repository for access by participants and the general public. The aim is to contribute to the body of knowledge.

4.10.3 Justice

Olejarczyk and Young (2022) defined justice as the act of ensuring that research aligns with the law and prioritises patients' rights and fairness. The ethical principle of justice was observed during the study and in the collation of the findings. In keeping with this, confidentiality, privacy and safety of data were ensured by not including any personal details in the interview or focus group scripts. The participants were expected to complete a demographics questionnaire (Appendix 7 Section A or Appendix 8 Section A) before the interview or FGD, respectively. This was used by the researcher to allocate an anonymous code for each participant. The interviews and FGDs were audio recorded with the participants' approval.

Participants' responses were not disclosed to anybody else except the researcher, supervisors, and an independent data analyst. As per the institution's guidelines, the scripts and any data collection paperwork were kept away and will be password-protected for five years. After this, they will be shredded or discarded appropriately. Furthermore, no conflicts of interest were associated with the study, ensuring justice for participants. Similarly, no conflicts of interest were present during the compilation of reports and the declaration of results.

4.10.4 Non-maleficence

Olejarczyk and Young (2022) defined non-maleficence as the act of ensuring that you do not harm. The principle of non-maleficence was observed in the study by ensuring that the study did not present any form of harm or risks to the participants. The data collection questions and sessions were kept professional and guided by the interview and focus group discussion guides. Additionally, participants were given the autonomy to withdraw from the study at any point if they ever felt that they were no longer interested. There was no conflict of interest or invasion of privacy, as confidentiality and integrity were prioritised during the study.

4.11 ASSUMPTIONS OF THE STUDY

Based on the researcher's perspectives, the following assumptions were aligned with this study:

- Philosophical assumptions – In line with the researcher's philosophical position, which is grounded in the social constructivist paradigm, knowledge was assumed to be co-created by the researcher and participants (frontline radiology staff). This co-creation occurs through dialogue and a shared understanding of the frontline radiology staff's mental health and well-being experiences during the COVID-19 pandemic. Also, it was assumed that reality is subjective, contextual and socially constructed. Therefore, reality could be influenced by the individual radiology staff's perspective, environment and cultural context (Chilisa and Kawulich 2012).
- The choice of research methodology and methods assumed that a phenomenological approach would enable the researcher to explore the mental health and well-being experiences of frontline radiology staff. Phenomenology allows for a detailed understanding of an individual's accounts and interpretations (Given 2008). It was assumed that participants (frontline radiology staff) could provide reliable and insightful accounts of their experiences during the COVID-19 pandemic. The study also assumed that through data saturation, sufficient data would be gathered to address the study's aim and research questions. The chosen data collection tools (interviews and focus group discussions) were assumed suitable for capturing the radiology staff's personal narratives of their experiences. The chosen data analysis method – IPA was assumed to allow for identification of themes that aligned with the participants' realities. It was assumed that the researcher would have access to frontline radiology staff within the eThekwini district. It was also assumed that these staff members would be willing to participate in the study at a time and place convenient to them.

- Ethically and reflexively, it was assumed that participants (radiology staff) would give honest and open accounts of their experiences. It was assumed that the researcher's background as a healthcare worker during the pandemic enriched the study by providing contextual sensitivity and a deep commitment to understanding the radiology staff's experiences. Reflexivity was incorporated throughout the study to ensure biases were managed without compromising the integrity of the study.

4.12 SUMMARY OF THE CHAPTER

This chapter outlined the qualitative, phenomenological methodology grounded in a social constructivist paradigm, which was used to explore the experiences of radiology staff. This approach aligned with the study's aims, research questions, and theoretical framework as detailed in chapters one and three. Semi-structured interviews and focus group discussions, combined with maximum variation sampling, were employed to ensure diversity across professional roles and healthcare sectors. Data collection followed ethical guidelines. Data analysis was conducted using the framework of interpretative phenomenological analysis, enabling a thorough exploration of participants' reflections and meaning-making processes (Smith, Flowers, and Larkin, 2022). Reflexivity, assumptions, and potential biases were addressed. These steps led to the study findings, which are presented and discussed in the subsequent chapters.

CHAPTER 5: PRESENTATION OF FINDINGS

5.1 INTRODUCTION

This chapter presents the findings from the data collection and analysis processes outlined in the previous chapter. It begins with an overview of participant characteristics, providing essential context for understanding the findings. The findings are presented as themes that emerged during the data analysis. Subthemes are presented as they emerge under respective themes. The themes reflect the researcher's interpretation of the data at that point in time. They offer a detailed and comprehensive view of the experiences of frontline radiology staff, in alignment with the study's aims and research questions. The findings are presented textually and in the form of a table where necessary. Table 5.1 provides a summary of the data collection questions posed to participants.

2: Data collection questions

Question 1	*Please describe how it has been working in your current job during the COVID-19 crisis.*
Question 2	Please describe your feelings around your safety (risk of infection) in the workplace.
Question 3	How have your professional duties been impacted by working during the COVID-19 crisis?
Question 4	What implications has working within a COVID-19 environment had for your health?

5.2 DATA REALISATION

Described by Kitchin (2014) as the process of availing the value of research data for use, data realisation entails data collection, storage, analysis, and interpretation to address set research aims, objectives, or questions. For this study, the steps of data realisation were explored in several chapters, covering data collection, storage, and analysis in chapter four. Data collection and analysis occurred in two independent phases, as presented in Figure 4.4. Data interpretation, which involved outlining the significance of the analysed data and developing practical recommendations from the gathered data, is discussed in chapters six to eight.

According to Xu, Liu and Meng (2024), factors such as security, confidentiality, and costs influence data sharing or realisation. In this study, data was stored by the researcher in accordance with the university's policy. Confidential primary data will be securely stored by the researcher for five years, after which it will be shredded. Electronic documents will remain on a password-protected computer and hard drive for five years, after which they will be transferred to external electronic media. This process was planned by the researcher during the proposal stage and implemented throughout the study.

The independent data analyst and transcription company did not have access to participants' personal details or demographics - only anonymised transcripts were shared. Aside from the researcher, only the transcription company had access to the audio recordings, which were anonymised to ensure participants could not be linked to any personal information. To maintain data quality in line with research needs, Guba and Lincoln's Trustworthiness framework was implemented throughout the study (Johnson and Christensen 2014). Participants' confidentiality and the privacy of their consent forms were safeguarded by using codes instead of names. Signed consent forms were stored separately from interview and focus group discussion notes and audio recordings.

The university sponsored costs associated with making the data accessible through publication, as part of its support for postgraduate research. Costs related to making the data understandable and usable included transcription of audio recordings from interviews and focus group discussions by a professional transcription company. This was funded through an academic support grant provided by the university.

5.3 DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

A total of 24 staff working in different radiology departments in the eThekwini district of KZN province participated in the study. As illustrated in Table 5.2, the majority of the participants were female (75%) and the prevalent ages ranged between 18-39. Radiographers in salary grades 1–3, explored in detail in the following chapter, constituted most of the sample. The study participants also included two enrolled (staff) nurses, the clinical head of the radiology unit, who is the most senior radiologist, as well as two radiography managers, who are qualified radiographers. The majority of the participants were working in public hospitals (66.7%). Frontline radiology staff from King Edward VIII Hospital and Lake, Smit and Partners Incorporated constituted a significant part of the sample, with 25% and 20.8% respectively participating.

The most experienced participants had more than 20 years of practice within their roles, while participants with 6-10 years of experience made up a significant portion of the sample (45.8%). Some participants were not attending to COVID-19 patients as part of their job responsibilities (12.5%), while 16.7% of the participants attended to more than 20 COVID-19 patients per week.

Table 5.2: Participants' demographics

Characteristic	*Categories*	*Count (n)*	*Percentage (%)*
Gender	Male	6	25
	Female	18	75
Age	18-29	8	33.3
	30-39	8	33.3
	40-49	7	29.2
	50-59	1	4.2
Professional status	Enrolled/staff nurse	2	8.3
	Grade 1-3 Radiographer	12	50
	Chief Radiographer	4	16.7
	Radiography Manager	2	8.3
	Radiologist	3	12.5
	Clinical Head of radiology unit	1	4.2
Workplace setting	Clinical (directly in contact with COVID-19 patients)	21	87.5
	Clinical (not directly in contact with COVID-19 patients)	3	12.5
Duration in the role (years)	2-5	7	29.2
	6-10	11	45.8
	11-20	4	16.7
	20 and above	2	8.3
Working environment	Public	16	66.7
	Private	8	33.3
Place of employment	King Edward VIII Hospital	5	20.8
	R.K. Khan Hospital	2	8.3
	IALCH	2	8.3
	PMMH	2	8.3
	KDH	4	16.7
	Phoenix CHC	1	4.2
	Lake, Smit and Partners Incorporated	5	20.8
	Jackpersad and Partners Incorporated	3	12.5
Number of COVID-19 patients attended to per week	None	3	12.5
	1-10	10	41.7
	11-20	7	29.2
	more than 20	4	16.7

To ensure anonymity, participants were identified according to codes consisting of a:

- letter – representing their profession.
- number – representing the hospital or practice at which they are based.
- letter – representing the participant number, as outlined in Table 5.3.

Table 5.3: Participants' codes

Nurses	*Radiologists*	*Radiographers (Public practice)*	*Radiographers (Private Practice)*
A3A	B1A	C2A	D9A
A6A	B1B	C2B	D9B
	B2A	C2C	D9C
	B6A	C2D	D9D
		C3A	D9E
		C4A	D10A
		C5A	D10B
		C5B	D10C
		C6A	
		C6B	

Table 5.4 further explains the codes used to identify the source of excerpts.

Table 5.4: Participants' codes explained

First letter (representing profession):	
A	Radiology Nurse
B	Radiologist
C	Radiographer in Public Healthcare
D	Radiographer in Private Practice
Number (representing hospital or practice they are based):	
1	Prince Mshiyeni Memorial Hospital
2	King Edward VIII Hospital
3	R.K. Khan Hospital
4	Phoenix Community Health Centre
5	Inkosi Albert Luthuli Central Hospital
6	King Dinuzulu Hospital
7	KwaMashu Community Health Centre
8	Addington Hospital
9	Lake Smit and Partners
10	Jackpersad and Partners Inc: Specialist Diagnostic Radiologists
Second letter (representing participant number):	
A	First
B	Second
C	Third
D	Fourth
E	Fifth

5.4 THEMES AND SUB-THEMES

Radiographers, radiologists and radiology nurses were asked to talk in as much detail as possible about their experiences while working during the COVID-19 pandemic. The participants' responses clustered around seven themes illustrated in Figure 5.1.

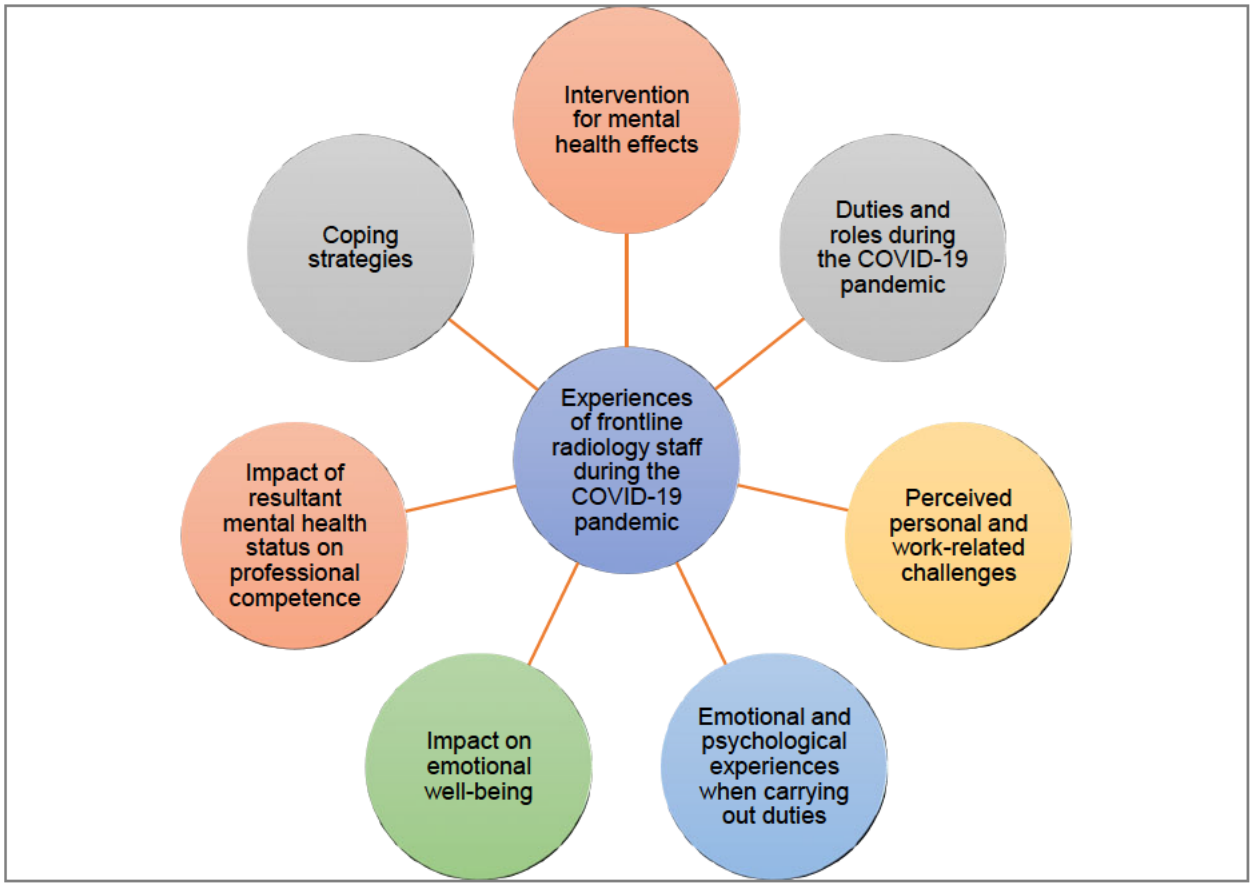

Figure 5.1: Mind map of emergent themes of the experiences of frontline radiology staff during the COVID-19 pandemic.

Table 5.5 further elaborates on the relationship between the themes and sub-themes, which will be described henceforth.

Table 5.5: Themes and sub-themes

Themes	Sub-themes
1. Duties and roles during the COVID-19 pandemic.	1.1 Use of radiology modalities in the management of COVID-19 patients.
	1.2 Role of radiologists.
	1.3 Role of radiographers.
	1.4 Role of nurses.
2. Perceived personal and work-related challenges.	2.1 Unpreparedness and perceived increased risk of infection.
	2.2 Adaptation to changes in systems, protocols and structures in response to the pandemic.
	2.3 Information about COVID -19.
	2.4 Physical health.
	2.5 Financial hardships due to the pandemic.
	2.6 Social shielding responsibility for family members.
	2.7 Disruption of social relations due to social distancing.
3. Emotional and psychological experiences when carrying out duties.	3.1 Fear of the unknown disease.
	3.2 Fear of contracting COVID -19.
4. Impact on emotional well-being	4.1 Emotional strain.
	4.2 Mental health challenges.
5. Impact of resultant mental health status on professional competence.	5.1 Attendance.
	5.3 Patient care and interaction.
	5.4 Adherence to protocols.
6. Coping strategies	6.1 Emotion-focused.
	6.2 Problem-focused.
	6.3 Barriers to coping
7. Intervention for mental health effects.	7.1 Emotion-based interventions.
	7.2 Problem-based approaches.
	7.3 Support-based interventions.
	7.4 Availability of space or platform to vent.

The following subheadings elaborate on the themes and sub-themes outlined in Table 5.5. Direct quotes from the interview and focus group transcripts are included to emphasise key findings. For each theme, the associated sub-themes and contributing keywords from the interview and focus group

discussion transcripts from which the themes and sub-themes were derived are indicated in Appendix 18.

5.4.1 Theme: Duties and roles during the COVID-19 pandemic

As participants gave an account of their experiences during the COVID-19 pandemic, they outlined the duties and roles involved during the time. The following sub-themes expanded on this theme: use of radiology modalities in the management of COVID-19 patients, role of radiologists, role of radiographers and the role of radiology nurses.

5.4.1.1 Sub-theme: Use of radiology modalities in the management of COVID-19 patients

With an increase in the demand for chest imaging to aid in the diagnosis and management of COVID-19, the radiology department was inundated with requests for chest x-rays. Portable chest x-rays, commonly referred to as Bed Side Units (BSUs), were frequently requested by clinicians attending to patients under investigation (PUI) in the COVID-19 isolation room or COVID-19 positive patients in dedicated COVID-19 wards. However, some departments conducted the examinations for PUI within the main x-ray department. The majority of both confirmed COVID-19 patients and PUI for COVID-19 had chest x-rays done, resulting in a drastic increase in BSU chest x-rays. The following excerpt from one participant evidences this:

"…the COVID-19 patients that are too sick are in the ward; so, the radiographer would go there to them. Sometimes we have a patient under investigation (PUI)...if they are walking and if they are able, the patient would come to the designated room and get their x-ray done." (C3A)

In addition to portable chest x-rays, several chest Computed Tomography (CT) scans were also conducted for both PUIs and confirmed COVID-19 patients. Considering that the departments under study only have fixed CT scanners, the patients had to come to the CT or radiology department for the scan. Computed

Tomography Pulmonary Angiograms (CTPAs) were the commonly performed scans for these patients. Additionally, Ultrasound scans were also conducted as part of the management of some patients. The following excerpt expands on this:

"… so, we do a lot of CT's for COVID-19 patients. It is mostly chest, followed by brain and then other areas of concern, other emerging findings maybe on x-rays or ultrasound…because sometimes the chest x-ray might not show much and, or even present as normal where the patient is very sick. So, the doctors now get scared that there is something they are missing, and they end up requesting CTs, just to make sure that they are not missing anything. We do a lot of chest CTs to look for pneumonia and other things that are COVID-19 related…Patients with COVID-19 have more chances of developing both deep vein thrombosis (DVT) and pulmonary embolism (PE)…so, they do a CTPA to look for PE…and we also find that some (COVID-19) patients present later…with chest pains or shortness of breath…after the COVID-19 has gone…so they have pulmonary embolisms that presents late. When they come back, the doctors request CT scans…and the two main things that we find in the late presentation will either be pulmonary embolism or lung fibrosis due to scarring...Some patients present with strokes, vasculitis affecting the brain, and some present with space occupying lesions….alongside that, with the abdomen, it is mostly ultrasound, but if they find something on ultrasound, those patients end up in CT scan as well for further evaluation of those findings." (B1A)

Further to the role of radiology during the COVID-19 pandemic, different duties and roles conducted by different professional categories within the radiology department were outlined as follows.

5.4.1.2 Sub-theme: Role of radiologists

During the COVID-19 pandemic, radiologists carried out tasks that included:

- Clinical duties and patient care

- Radiology reporting, consultation, screening of patients and justification of radiology requests.
- Infection prevention and control.

Radiologists continued to place intravenous lines, inject contrast media and conduct various ultrasound scans from the patients' bedsides as well as in the radiology department. This involved close interaction with patients. One radiologist had this to say:

"I do everything. So, I do the intravenous (IV) lines, the injections, the ultrasounds, sometimes it was in Accident and Emergency (A&E) so I am in their hotbed basically. Things like also doing the ultrasound in very close contact with the patient and we have no screens. It was rare that we had to do a positive patient urgently for Ultrasound. I think probably that and injecting would have been the highest moments of anxiety…the ultrasound took a lesser set of precautions, but it was not anything complicated that needed me to spend an extended amount of time with a patient." (B6A)

Mammograms were also conducted mostly after the total lockdown. The following statement outlines this:

"Normally, we would only conduct mammography exams on six out-patients, but after lockdown we had to go with 10 patients a day to recover the backlog because there was a backlog. I must have seen around 300 patients at that time, so actually during lockdown it was quiet, but after lockdown the numbers had been increased." (B2A)

Furthermore, radiologists continued to report on x-rays, CT, mammograms, and any other radiology procedures that were being conducted in their respective departments. This was coupled with ongoing in-house training to develop expertise in identifying COVID-19 and related complications on radiology images. The following excerpt expands on this:

"…when we are doing the continuous education in the department, we have to include COVID-19 and focus more on that…especially as the Head of Department, I have to make sure that the doctors (radiologists) are aware of all these manifestations of COVID-19…because it is not about the chest only…but COVID-19, as we know, it can affect any system and any organ compared to what we were initially told. And those patients present with funny findings so as radiologists we need to be aware of that so that when we pick them up on CT, x-rays, ultrasound images and we can be able to link them to COVID-19, so that the patient can get proper treatment." (B1A)

Additionally, they were also involved in consultation with referring doctors, screening of patients and justification of radiology requests as outlined in the following excerpt:

"…now we have to see if the patient is COVID-19 negative or COVID-19 positive. Or if the patient is not tested then we will not do the radiology exam." (B2A)

Other radiologists were also involved in formulating Infection Prevention and Control (IPC) protocols within their departments as outlined in the following statement:

"…radiographers do not take part that much in protocol development in clinical (i.e. radiographers are not involved in formulating protocols); radiologists do." (C2D)

Like any other healthcare worker, radiologists were also involved in IPC protocol implementation during radiology procedures, as indicated in the following statement:

"We took out curtains. We removed our curtains, but that meant I had to close the door, we worked with PPE, cleaned our machines thereafter. I mean we did the best we could under the circumstances, but like I said it was rare that

we had to do a positive patient urgently…The injecting was quick and the ultrasound took a lesser set of precautions…we isolated rooms as designated for positives or PUIs, batched patients." (B6A)

5.4.1.3 Sub-theme: Role of Radiographers

Radiographers' duties and roles during the COVID-19 pandemic included:

- Conducting radiology examinations.
- Infection prevention and control.
- Management.
- Screening x-ray request forms.
- Patient care and interaction.
- Administrative duties.

Radiographers were involved in carrying out various radiology examinations that were offered by their respective departments. Hence, there was continued close contact with patients (PUIs and COVID-19 patients included). The tasks comprised registering patients, entering patients' details onto the radiology information system, positioning the patient, patient care and forwarding imaging for reporting for x-rays, CT and mammography. There were slight differences in responsibilities between radiographers in public and those in private practice. A radiographer based at a public healthcare institution had the following to say:

"Because radiography is a teamwork…they are allocated to work together…in the orthopaedic x-ray department there is only one room and one needs to be entering the patients' details because the patients are a lot for one radiographer to do everything alone, the work will not flow. While one is entering the details, the other radiographer has to position and another can take cassettes and process them…you will be helping each other to lift the patient… if you are working in CT scan, one will be entering the patient's details into the system; while the other one is positioning the patient and connecting the IV lines (intravenous)." (C2D)

Radiographers in private practice administered contrast media (CM) hand injections while those in public practice did not. The following statement from a radiographer based at a private radiology department expanded on this:

"…sometimes, I would administer contrast media hand injections on night duty because I did not have anyone else on site. Our radiologist then agreed to take responsibility for it. But very seldom we get a contrasted brain mainly… injury or just like something that does not need contrast like looking for a bleed or something." (D9E)

Furthermore, radiographers were actively involved with implementation of infection prevention and control protocols before, during and after radiology procedures. Tasks included donning and doffing PPE, disinfecting radiology equipment and accessories, preparing the radiology rooms for COVID-19 patients and staff temperature checks. One radiographer had the following to say:

"With the BSUs…donning and doffing, with all of the patients, even when they are PUI patients. And then the CTs, most of the time they come in as inpatients so there you generally have to clean out everything… clear out the whole room and take everything out that basically can be carried out… We really wiped down the machines and the tables after every patient. We are using the protective sheets and linen savers on the bed now; we do not use normal sheets... Also, every morning, we have to do a proper wipe down, zap the room in the morning, midday and the evening… doing daily temperature checks and everything, you have got to answer a bunch of questions…" (D9A)

Radiology departments based in public healthcare institutions were restricting entry into radiology rooms after imaging of a PUI or COVID-19 patient, as outlined by the following excerpt:

"For general x-rays we should not wait at all. We attend to them one after the other but we clean the equipment in between them…sometimes you have to

wait for two hours to clean and then close the department to ensure that we do not bring in other patients to the department following the imaging of a COVID-19 positive patient in the department…in CT scan, we are still adhering to closing the department for two hours after scanning a PUI or COVID-19 positive patient." (C2D)

Some radiographers were involved in running the department as they are either chief radiographers or radiography managers. Their duties included decision-making relating to duty rosters, IPC supervision and availability of PPE. One radiography manager had the following to say:

"…being a radiography and venue manager, I have implemented tactical ways of how we could work around the PPE shortage issue. Some of them wanted all the PPEs they could find, they needed this and that. So, you had to… advise them that it is not only about wearing PPEs here, when you are out there, as well, you have got to be safe." (D10A)

Radiographers' duties during the pandemic also included screening x-ray request forms for patients' COVID-19 status. This involved ensuring the patient's screening form did not indicate any red flags, such as out-of-range vital signs. Radiographers also raised any obvious and suspicious COVID-19-related radiology findings with radiologists for follow-up. The following statement expands on this:

"…when I first get a patient now, the first thing I ask them is the screening tools so see if they have passed COVID-19 screening checks or not. That it one of the major changes." (C4A)

Considering that radiographers need to be in close contact with patients during most radiology departments, their duties included frequent patient care and interaction. In addition to other duties mentioned, radiographers had to conduct administrative tasks from time to time, such as clerking patients, and

interdepartmental communication, mostly via telephone. The following excerpt exemplifies this:

"In radiography we work in contact with patients. So, the type and nature of our job makes it very difficult to say you will social distance from the patient because every patient that comes requires you to position them and you need to be in contact with them, you need to touch them, you need to turn them around for the lumbar spine x-rays. You need to be near where they are and you can only move away when you are exposing…one will be entering the patient's details into the system..." (C2D)

5.4.1.4 Sub-theme: Role of radiology nurses

Radiology-based nurses were involved in patient preparation and after-care of the patient. Additionally, nurses assisted during radiology examinations by checking the IV-line, injecting contrast media and monitoring the patient whenever a radiographer was attending to either a PUI or COVID-19 patient alone. While working in close contact with PUI and COVID-19 patients, nurses were also involved in practising IPC measures such as donning and doffing PPE. The following statement elaborates on this:

"… at one of the private practices usually the nursing sister checks the injection and we draw it up (contrast media), but she is the one in the room to check it. So, most of the time, if you do not have a second radiographer with you, then the nursing sister would put PPE on and she would be your second radiographer and she would go in and check your line and check that we have made a successful IV. The nurse administers the contrast hand injections." (D9E)

5.4.2 Theme: Perceived personal and work-related challenges

Challenges faced by frontline radiology staff at personal as well as work-related levels fell into the following sub-themes, which are expanded on in subsequent sections:

- Unpreparedness and perceived increased risk of infection.
- Adaptation to changes in systems, protocols and structures in response to the pandemic.
- Information about COVID-19.
- Physical health.
- Financial hardships due to the pandemic.
- Social shielding responsibility for family members.
- Disruption of social relations due to social distancing.

5.4.2.1 Sub-theme: Unpreparedness and perceived increased risk of infection

Most of the participants in public practice reported that they never felt safe in the workplace from the onset of the pandemic. They felt that they were at an increased risk of contracting the virus due to a plethora of issues, ranging from inadequate PPE to a lack of information about the spread of the virus. The COVID-19 pandemic exposed how unprepared most hospitals were in the event of a major disease outbreak. PPE was virtually non-existent in the early days. When it became available, staff were unable to wear it properly due to a lack of training on the donning and doffing of the PPE. The problem was even worse for radiographers who were not considered to be frontline workers; hence, PPE was only reserved for doctors and nurses, especially in public hospitals. This is noted in the excerpt below:

“.... even though there are guidelines, it has been very stressful because of the lack of PPE specifically. It was at an institutional level for a certain while, then it was departmental… like the N95 masks were a shortage... they were telling us that it is the people who physically deal with the patients then it was people who do the swabbing of the patients. That is because it is an aerosol procedure,

so they would need it more. We do come in direct contact but recently we did have a meeting and we were told by one of the sisters in charge, that we do not actually need a gown, just a plastic apron would be sufficient for us to x-ray the patients. And that our hand hygiene needs to be followed." (C3A)

The situation differed in other radiology departments. A significant proportion of those employed in private practice confirmed that PPE was never an issue. Management ensured that supplies were always available, as indicated in the following excerpt:

"So, we were given all the equipment, whatever we needed. Well, I was very impressed with my place of practice. We were not limited on any number of PPEs. So, I was very happy at work, for we were actually given disposable scrubs. We were given aprons, disposable gowns. We were double gloved, used double booties, unlimited N95 masks. So, we did not have to use one for the entire day or one for so many hours. And when I would do maybe 6 COVID-19 cases at a time in COVID ICU, if I was in one room, I would use the same PPE, but change the apron and gloves between the patients." (D9E)

Radiologists working in public hospitals also echoed the same sentiments as the radiographers in public practice with respect to the shortage of PPE in the workplace. This made them feel unsafe, especially when doing examinations that required close contact with patients. They attributed this shortage of vital PPE during the pandemic to a lack of commitment by management. Specifically, management was not committed to the safety of employees. A participant had the following to say:

"…. not from management, I must admit (we do not get support from management). I did not have PPE for a weekend for example. Within the department yes there is support. I am talking about outside the department, that we are a department at risk because we see nearly every patient. It was not really recognised at the beginning that we are. We were not triaged as

significantly at risk, it was a little bit offensive, I felt…. the PPE was an issue…the lack of PPE." (B6A)

Severe PPE shortages as a result of reluctance by management to source adequate stocks were further highlighted during the FGDs. A sizeable proportion of respondents were of the opinion that management was reluctant to buy PPE, thus deliberately putting employees at risk. Most employees resorted to buying their own PPE to protect themselves at work. The following excerpt expands on this:

"…. *we are still not fully equipped with the equipment to efficiently protect ourselves and this is coming from their directive (management). It comes from the people who do not even come into contact with COVID-19 patients. They do not even know how it feels and they do not even understand how important it is to us…they do not care and think that whatever they are giving to us as PPE is adequate and suitable…we are not being given the mask that we at least should be given. There are many days that I have gone, and they said there are no masks…that just tells you that there is totally no response or acknowledging of the people coming in contact with these patients, they just do not seem to care… if we cannot get the basics, then I feel that we are all still at risk.*" (C2A)

Other frontline radiology staff believed the shortage of PPE was beyond the radiography managers' control since decisions were made by management above their rank. One radiographer based at a public healthcare institution had the following to say:

"Yes, radiography management has to fight and also had to make sure that we received protected clothing (PPE) but sometimes this goes beyond that because in government we are using the ordering procedure (policy) where you will find that head of departments can approve as an AD (Assistant Director) of Radiography, but this does not go straight to the Stores department. They must go through a channel of local managers…so, that is when the radiology

manager had to step in and talk to the nurse manager to explain the type of job that we do. One of the managers bought us a D-germ light…so, they are mounted on the wall in the department. We have got about eight if not nine of them." (C2D)

In most private practice centres, however, management was proactive in sourcing PPE for staff. They ensured that staff were safe at work. They also made sure that the staff's mental health was cared for, since patients needed to be attended to, as exemplified in the following statement:

"…. there was a shortage of PPE, but I think being management radiographer and venue manager, I have implemented tactical ways of how we could work around the PPE shortage issue…because the patients had to get x rayed and it was presented that you need to work around it. You cannot say, okay, we have got no PPEs, we cannot x-ray patients. You have to have a proactive mind and use some logic and work around that." (D10A)

In most cases, management was caught wanting during the pandemic as their actions were not up to the standard that employees were expecting. Participants felt that their experiences during the pandemic were made worse by the dormant nature of management in times of crisis. Management response was described as non-empathetic. This was especially evident when granting sick leave to employees who tested positive for COVID-19. It was also seen in the lack of protection for staff with co-morbidities. A participant based in a public healthcare institution had the following to say:

"There was no assistance or support obtained from management, during all of this (tested COVID-19 positive). I was asked if I am sure I cannot make it to work." (C4A)

Frontline radiology staff raised concerns indicating structural deficiencies of their radiology departments during the COVID-19 pandemic. Participants

perceived that the radiology departments and management were not prepared for the pandemic with regard to staffing, as outlined in the following excerpt:

"When I showed symptoms and took COVID-19 leave, because the results do take a couple of days to come and the added isolation time due to COVID-19, I was not at work for a good two weeks, and there was no one carrying on the work in the department, because I am the only one. Yes, the department was closed when I was off sick. So, unfortunately, the x-ray patients had to go to other x-ray departments in other hospitals…staff shortage has also contributed to this." (C4A)

Other participants perceived that radiology departments based in public healthcare institutions were not structurally geared to ensure implementation of COVID-19 related IPC protocols. This perception is illustrated by one of the radiologists in the following excerpt:

"…. the hospital itself…especially the radiology Department, was not geared for things like social distancing and also to deal with the pandemic…the reason for that is…the structural lay-out of the department…but the biggest issue we had as well was with the doctors coming to discuss cases. Here you have a big room of doctors coming to look at images and discuss cases, so you have to tell them only one person must come in, or telephonically discuss the case. But…PACS would have made a very big difference all around." (B2A)

Most radiographers found the donning and doffing of PPE cumbersome and time-consuming. The PPE was not comfortable to wear for longer periods. In addition, there was a need for cleaning equipment between patients as well as after the visit to the COVID-19 ward. Ultimately, radiographers found themselves with an increased workload and at times it was overwhelming. Staff shortages also contributed to the challenge of work overload. A radiographer in private practice had the following to say:

"It has impacted patient waiting time a lot, because we cannot do as many patients as we would like to, because of cleaning time. It does increase the workload because sometimes, if there are plenty procedures with COVID-19 patients for examinations such as lumbar puncture or…(any) screening procedure that takes long… the cleaner has to be cleaning that and she cannot be in two places and then you have to wait that long also...The biggest thing is the lack of staff. If we had more staff, I do not think we would have been in the situation we were in…my call was coming around so quickly …" (D9E)

In order to circumvent this scenario, radiographers in senior managerial positions, who were mostly doing non-clinical duties prior to the pandemic, started chipping in. They helped radiographers with some clinical duties, as outlined in the following excerpt:

"…. then as managers we had to help, like with BSU's, CT scan we had to roster ourselves so that we can ease the load on radiographers." (C6A)

The frontline radiology staff in public hospitals noted a reduction in patient volumes whenever national alcohol bans were implemented and a drastic increase in patient numbers whenever the ban was lifted. This was more specific to trauma and COVID-19 patients as outlined by the following excerpt:

"…. we have noticed that even now with the third wave, workload has increased as well…we definitely noticed that when there is an alcohol ban, it is much better in the hospital to deal with the patients. But once the alcohol ban has been lifted, trauma cases have increased and COVID-19 patients have increased as well." (C3A)

Radiologists also experienced an increased workload, particularly following the initially intense lockdown. Elective cases were rescheduled, and the ongoing workload increased the weight. Resultantly, patient waiting times were increased. The following excerpt illustrates this:

"We were in lockdown for I think almost a month, the backlog of elective or semi-elective cases that were cancelled added onto the workload. So, it was not only mammography exams. Normally, we would only conduct mammography exams on six out-patients, but after lockdown we had to go with 10 patients a day to recover the backlog... I must have seen around 300 patients at that time, so actually during lockdown it was quiet, but after lockdown the numbers had been increased." (B2A)

In addition, almost all radiology departments were not structurally designed to cope with a disease outbreak of the magnitude of COVID-19 in terms of space and ventilation. Thus, it was a challenge for most departments to separate high-risk patients from low-risk patients within the department. This then hampered any efforts of trying to curb the spread of the virus within the hospital setup. Furthermore, poor ventilation also meant an increased risk to staff members working in those locations as well as non-COVID-19 patients. One radiographer had the following to say:

"…. our OHC (Occupational Health Committee) officer came to assess our environment and they found that we do not have a good ventilation system in place. No extractor fan, nothing. So, we were advised that when you have a COVID-19 patient, you need to clean up, close the department and wait for specific hours for fresh air to come in but now the dynamics are changing every day because most of the patients that are coming in the hospital are either PUI or confirmed COVID-19 cases and hospital management felt that closing the department is delaying patient's management." (C2D)

Radiologists were equally affected by these flawed designs in the reporting rooms, as it became impossible to enforce social distancing rules. In situations where other clinicians had to consult with radiologists for clarity on patient diagnosis, the reporting rooms became overcrowded. This is outlined in the following excerpt:

"…. and even in our reporting suite, that reporting suite is less than 2m², and there are almost 10 radiologists reporting in that small area." (B2A)

Despite this, the radiology staff tried their level best to adhere to IPC protocols for the safety of both staff and patients. One participant had the following to say:

"…. but as far as possible, we are trying to be as cautious; hand hygiene, keeping our mask on all the time. We are trying our best." (C3A)

However, some participants raised concerns about inconsistencies in protocol implementation in departments. A participant had the following to say:

"…. it is shocking because when it comes to x-rays they say we should not close the department but when it comes to CT we must close … the challenging part is that radiographers do not take part that much in protocol development in clinical (i.e. radiographers are not involved in formulating protocols); radiologists do and in most cases I feel they use or implement these protocols when it suits them. Because in CT scan, they are present in the scan room, so they are scared that the virus might still be there and they do not want that – but, because we are radiographers you will still be involved with x-rays which they do not need to report. Nobody cares whether the virus is still in the x-ray room or not." (C2D)

At the beginning of the pandemic, PPE was scarce, especially in public hospitals. Moreover, radiographers and radiology nurses were not considered to be frontline workers; hence, they were not being prioritised during PPE allocations. This meant that they had to attend to patients without enough protective gear. The majority of patients coming to the radiology department were mainly PUIs. This increase in workload, combined with inadequate PPE, led radiographers and radiology nurses to feel unsafe in the workplace. They perceived themselves to be at an increased risk of contracting the virus while executing their duties. Some participants indicated that they could not adhere

to the full IPC protocols due to inadequate or incomplete PPE gear. A radiographer had the following to say:

"…. in our institution… the other healthcare workers (in other departments) seem to get the full PPE while we are all struggling…we usually end up getting it from them if you are lucky, or if you get it, sometimes, it does not even fit you, so it is in completely non-usable size. I think across the board that is actually one of the points of concern because…certain departments get N95 masks, but with us, because they say that we are not there with the patient continuously…" (C2A)

Some of the radiology staff were concerned about frequent cases of referring clinicians not providing enough information about their patients, such as their COVID-19 status. This resulted in radiology staff not implementing recommended protocols to protect themselves, other staff and patients. However, in some hospitals, the referring clinicians were advising the radiology staff of the patient's COVID-19 status beforehand. One radiographer had the following to say:

"I received a call from work to advise me that the patient I did a CT scan on from this particular ward had just tested positive although the patient came in as a normal patient. Yes, I was wearing a mask but I was not geared up (donned – PPE) for that COVID-19 patient …they sometimes just bring patients just like that and act like the patients are fine of which we rely on the request form and what is written by the clinicians. So, you can never say you are safe. Our life at work is very risky and sometimes these risks are caused by our very own fellow colleagues because they do not disclose the information to you." (C2D)

5.4.2.2 Sub-theme: Adaptation to changes in systems, protocols and structures in response to the pandemic

With the onset of the pandemic, it became evident that it was not business as usual anymore. With hospitals filling up with COVID-19 patients, radiology departments witnessed a sharp increase in their workload, especially for CT and chest x-rays, as outlined by the following excerpt:

"…. we never used to see so many Computed Tomography PE scans (CTPEs) as what we are seeing now…We have also done a handful of HRCTs (High resolution CT) but the CTPEs have probably been the biggest increase, but overall, the BSUs are by far the biggest amount that we have increased at." (D9A)

Modalities such as mammography, however, saw a decline in patients as a result of cancellations of elective cases. The rising number of COVID-19 patients requiring imaging services led most departments to adjust their systems and structures. These changes were made to adapt to the demands imposed by the pandemic. The following participant's statement expands on this:

"…. at the beginning, with the initial lockdown, we cut on our elective work. What we have seen is the consequence of that this year where our malignancies are coming back at a higher stage disease and that's a bit distressing. I feel like we could have done better…. we changed a lot of protocols within the department at the time and a lot has worked… we plan our positive (COVID-19) CT scans." (B6A)

The demand for CT escalated exponentially. To accommodate this surge in demand, most departments had to adjust their booking system. This was done to work efficiently while ensuring that patients and staff members were kept safe. A common pattern emerged in most departments, both in private and public practice, whereby CTs for COVID-19 patients were booked late in the

afternoon. This ensured that non-COVID-19 patients could still be attended to in the morning. Then, in the afternoon, CT departments could attend to COVID-19 patients. A participant had the following to say:

"We can sometimes wait about twenty to thirty minutes for the ward to bring the COVID-19 patient down so it does delay us quite a bit. We often end up trying to…push the patient a little bit further on in the day, so that it does not create a huge impact on our list during the day…because you have got to wait for the patient to come down, scan the patient, then you have got to do a full clean of the room and everything, so that has made it a bit of a challenge. If it is a really urgent scan, sometimes we will try and squeeze it in where we have got a gap, but generally we do try and sort of wait a little bit later in the day when we are not… busy..." (D9A)

In addition to changes in the booking system, some radiology departments introduced the closure of imaging rooms or departments. These closures lasted for at least two hours after imaging either PUI or COVID-19 patients in those rooms. This is outlined in the following excerpt:

"…. we were advised that when you have a COVID-19 patient, you need to clean up, close the department and wait for specific hours for fresh air to come in … You will need to finish your booked list of patients first before you can call a PUI or COVID-19 patient because in CT scan, we are still adhering to closing the department for two hours after scanning a PUI or COVID-19 positive patient." (C2D)

Changes in protocols, staff shortages, and staff infection with COVID-19 severely impacted duties and shift rotation. Breaks were also affected to cater for the volatile shifts. Whenever a staff member called in sick, there was a need to replace them for the continuity of service delivery. This resulted in some staff working extended shifts and changes in duties. To mitigate the spread of the virus among staff and reserve staff in cases of virus outbreak, some departments staggered shifts and staff to avoid mixing. In public hospitals, as

more and more radiographers started getting sick after contracting COVID-19, senior radiographers in managerial positions became even more involved in clinical duties in order to mitigate the staff shortage. The following excerpt illustrates this:

"…. as you know that public hospitals are facing a shortage of staff…so because we now started to see a lot of patients…we had to come up with a lock down roster…and that was not easy. Then as managers we had to help, like with BSUs and CT scans… we had to roster ourselves so that we can ease the load on radiographers…it was even difficult to make a weekly roster because…there is not enough staff…you never know who is going to be present at work on that day, you will never know who will test positive the following day…" (C6A)

Introduction of new cleaning protocols and prolonged usage of PPE presented further challenges, as exemplified by the following excerpt:

"I would say that there is an added time to be seeing the patients, especially if I get a COVID-19 patient, the normal patients are affected, because of all the cleaning procedures and the waiting for the room because we only have one room. We wait for about twenty minutes for next patient to come in, after it has been deep cleaned. And with a special solution and stuff... just being uncomfortable in your work uniform, with all the PPE." (C4A)

As a way of mitigating the spread of coronavirus, departments introduced social distancing in the workplace. However, this presented challenges due to the limited space and the department's structural setup. The following excerpt expands on this:

"…. social distancing is a big challenge… you can find yourself at some point having about 86 patients waiting on one spot and our waiting area is not that massive. So, it becomes very challenging to actually adhere to social distancing directives …In radiography we work in contact with patients…the

type and nature of our job makes it very difficult to…social distance from the patient… among colleagues, it is not very practical unless you are working in two different departments … Because radiography is a teamwork you cannot necessarily social distance." (C2D)

5.4.2.3 Sub-theme: Information about COVID-19

In the early days of the pandemic, there was scant information about the spread of the virus. There was also little guidance on the proper ways to prevent contracting the virus, or even better, to reduce the risk of contracting it. These challenges increased fear amongst frontline radiology staff, radiographers included. Moreover, in most cases, radiographers complained that clinicians were not providing enough clinical information regarding the COVID-19 status of the patient. Thus, they were blindly attending to PUIs only to know that they were under investigation when the patient's results came back positive. The excerpt below exemplifies this:

"I think everybody was sort of trying to find their feet, and figure out how everything works... Especially in the beginning, there was not a lot of…guidelines about PPE and how to treat the patients, and information on what your infected windows are and all that type of information." (D9A)

The initial fear slowly faded as PPE allocations started improving, coupled with the rollout of the vaccine programme. This saw a sizeable proportion of radiographers feeling safe in the workplace and eager to continue with their duties. However, a number of them had contracted the virus once or twice by then, as outlined in the following excerpt:

"…. yes, definitely, I am no longer scared. Especially now that I am vaccinated also…the major implication was contracting COVID-19…and since then I have not been a hundred percent." (C4A)

With improvements in PPE allocations, many radiographers began realising that workplaces were actually safer in terms of contracting COVID-19 compared to public places like supermarkets. This understanding helped reduce the fear surrounding attending to COVID-19-positive patients, as they knew they were protected. Amongst radiologists, the fear was more to do with request forms acting as fomites, thus increasing their risk of contracting COVID-19. Due to the increase in the demand for chest imaging, radiology departments were inundated with chest x-rays and chest CT requests. In departments where paper-based requests were still in use, this meant that requests had to pass many hands from the requesting clinician up to the reporting radiologist. Without proper adherence to IPC protocols, radiologists faced a risk of contracting COVID-19. At that time, it was hypothesised that the virus could be transmitted through contaminated surfaces. One radiologist had the following to say:

"Request forms were more like fomites as they were passed through five or six people before they reach the radiologist, thus increasing the chance of spreading COVID-19 to radiologists." (B2A)

Participants reported concerns around poor interdepartmental information sharing when caring for PUIs. There were reportedly several cases of incomplete request forms (missing information on the patient's COVID-19 status). This would result in an increased possibility of exposure to the virus since staff would not have been provided with information advising them to wear the appropriate PPE gear. A radiologist had the following to say:

"I think from the beginning it was a lot more stressful…because we did not understand…whether patients were being actually identified as PUIs… We were not getting that information…Obviously, there were mess-ups, but…if we found suspicious radiographs, we actually go back to them, and they were good enough to test." (B6A)

5.4.2.4 Sub-theme: Physical health

Almost all respondents confirmed suffering from physical exhaustion as a direct result of working during the pandemic. The added IPC measures to reduce cross-infection resulted in an increase in the workload for most radiographers, especially with regard to the donning and doffing of PPE. This meant examinations were taking longer, and this took a toll on the physical health of radiographers. The following excerpt outlines this:

"…. it was tiring when we had the waves…1, 2, 3. It was very tiring…I think because of…the pressure of dressing up, dressing down (donning and doffing), it was a tedious process and ensuring the machine and everything was wiped regularly." (D10A)

It was a bit difficult to breathe while wearing the PPE, and the heat generated made it uncomfortable and heavy to work in. At the end of the day, most radiographers were tired due to running around doing BSUs. One radiographer had the following to say:

"I remember working on Boxing Day when I was pregnant. I got called in the morning, for four call BSUs. By the time I had driven to work, I had got call for sixteen COVID-19 BSUs. But it was exhausting at one point..." (D9E)

Staff shortages and a lack of assistance from other healthcare professionals during BSUs added more physical strain on the radiographers. One radiographer had the following to say:

"Another issue that made it stressful while working during this pandemic was the lack of assistance while doing BSUs, specifically with the COVID-19 patients, because there is such a shortage of staff, including nurses. It has been difficult for us to x-ray patients as well. Also, the workload has increased with COVID-19 patients. Recently, we have noticed that even now with the third wave, workload has increased as well." (C3A)

Some respondents were not so lucky and they ended up contracting COVID-19. This affected their physical health mostly due to the pain and fever. Some even developed long-term effects of COVID-19 (long COVID-19). As a result, they would tire easily and have breathing difficulties. The following excerpt outlines this:

"The major implication was contracting COVID-19. And since then I have not been a hundred percent. Like, I get tired quite a lot more frequently than I used to." (C4A)

Other health-related issues, coupled with the physical burden of working during the pandemic, put an added strain on some radiology staff. This was mostly in the form of chronic conditions and natural factors such as pregnancy. Lack of support from management despite these challenges stressed the frontline radiology staff, who had to come up with ways of looking out for their health. A participant had the following to say:

"From a personal side I have a chronic condition that needed immunosuppression and that is when I was most fearful. I did not think management appreciated the level of immunosuppression I was at. On my second relapse I upgraded my medication to a phytotoxic medication because I wanted to cut short my inflammatory period and it was just before the vaccine so part of the motivation was I had to take the vaccine. Accessibility to the vaccine was poor on our side, so we were hearing about other hospitals where everybody was vaccinated, right down to the security and the porters and we were still waiting…so, I made changes in my own management of my health. It has not been the right decisions though relapses came since then." (B6A)

5.4.2.5 Sub-theme: Financial hardships due to the pandemic

Most radiographers working in private practice who are paid according to the number of patients they attend to in a day reported facing financial difficulties as a result of the COVID-19 pandemic. With a decline in the number of patients

due to the cancellation of elective cases, a number of radiographers experienced salary cuts by margins as high as 50%. One radiographer had the following to say:

"From the financial point, there were salary cuts because the company was not making a lot of money. Salaries were cut by up to 50%. Initially, they told us there are no salary cuts…when it came towards pay day, we were just told we are getting a…50% salary cut…for those whose contracts were up for renewal, they were completely not taken up, all the money we had saved for (that) trip, that is the money that we used when we had a salary cut… We were working on call, driving out multiple times in the night on a reduced salary and not getting paid" (D9E)

The situation was made worse when one got COVID-19, as one had to pay out of pocket for COVID-19-related services, which were very expensive. This left a huge dent in the finances of most frontline radiology staff. The following statement exemplifies the participants' concerns:

"So, it has affected me, and also with the financial implications as well, because those financial burdens, they affect your health and they become stress and all of that. So yes, then with those admissions and those treatments that you take post-discharge and all of that, the medical aid will have certain things that they will not cover, and you have to buy them yourself and all of that. So, it also affected me financially." (B1A)

5.4.2.6 Sub-theme: Social shielding responsibility for family members

In as much as respondents were scared of contracting the virus themselves, they were even more worried that they were going to carry the disease home and pose a danger to their immediate families. Respondents who were staying with their parents were even more worried, as the elderly were more at risk of succumbing to the disease due to co-morbid conditions. One radiologist working in the public sector aptly summed up this worrisome feeling:

"So, being a healthcare worker, I think what has impacted on me is being at work because the main thing is when you go home, interacting with your family, with your friends, you have to make sure that you know in the back of your mind you need to be 100% sure that you did not slip up somewhere and for example not have a mask on or not sanitise and you put them at risk…For example, if I thought I had a sore throat… I used to sleep in the other room. And it was, emotionally…very, very stressful." (B2A)

The majority of respondents felt that they posed a danger to their families as a result of their working in the hospital, attending to COVID-19 positive patients. A radiographer working in private practice concurred with this assertion and had this to say:

"Psychologically, because we work with COVID-19 patients, I do not want to visit my parents, I do not want to visit relatives, because we are working with COVID patients... I never visited my parents when I was working in the hospital, because they are compromised in terms of their co-morbidities." (D10A)

One radiographer who was pregnant at the peak of the pandemic confirmed that, due to fear of contracting COVID-19 and potentially bringing complications to her unborn baby, she had to double-glove and double-gown. The desire to protect families from COVID-19 led most respondents to take extra precautions at work so as to reduce the chances of contracting the virus. The concerned participant had the following to say:

"…. I was pregnant, but I still worked through the second wave. So, I worked through that entire wave, double gloved. I just double-gowned at times because I was doing night calls, pregnant, and I had like nearly five calls in a night..." (D9E)

Everyone felt responsible for protecting their families from the virus since they worked on the frontline on a daily basis. Most radiology staff reported that they would change clothing, shower, and wear clean clothes after every shift when

they got home. They did this before interacting with members of their immediate family in the household. They felt this protected their family members, who were home most of the time since the country was under lockdown. However, the lack of adequate PPE in most departments left the majority of healthcare workers feeling vulnerable to COVID-19. The following excerpt exemplifies this:

"…. so, I recommended that we use the patients gown like they come out of the laundry, use it over your clothing, you doff it before you leave the department to ensure that you are not carrying infection home. I also came up with the idea of spraying your shoes before leaving work, because you have people jumping into your vehicle or their own wearing an exposed second outfit over their clothing…" (D10A)

5.4.2.7 Sub-theme: Disruption of social relations due to social distancing

Social distancing became popular during the pandemic as a measure to reduce the spread of the virus. This was especially true when it became widely accepted that COVID-19 spread quickly via droplets. In the workplace, social distancing resulted in reduced interactions with colleagues as outlined in the following excerpt:

"You know, we like to order food. We could not do that. Our social events in the department, these are the things that keep us together as a team, were limited and there was change in the nature of those." (B6A)

There were limits on the number of people who could be in a room at a particular time. During break times, staff were expected to maintain social distancing when having meals, as they would not be wearing masks. The limited interaction affected working social relations to some extent, as there was no peer support in times of need. One radiologist had the following to say:

"Psychologically, I think I probably experienced a lot more isolation for me because I did not really go to visit the other wards, so now we do an A&E ward

round with them. I stopped that. Doctors were not allowed into our department because I am technically in the clean zone so things changed." (B6A)

Outside of work, most respondents agreed that their relationships with family members were somewhat strained. This was because they could not visit each other as often as they used to in pre-COVID-19 times, as outlined in the following excerpt:

"…. not seeing family was a very big challenge for me because I am very close to my family and they live in a different town, that was very hard for me. It does get a little bit lonely, obviously now it has gotten a bit better but you do get a bit lonely and get a bit pent up because you cannot do the things that you normally do. I actually feel like we have become almost less sociable now. Not easy, obviously we tried to phone and video chat and just keep in contact and then as things started lifting, and started to get a bit better that we were able to see people." (D9A)

5.4.3 Theme: Emotional and psychological experiences when carrying out duties

Frontline radiology staff's emotional and psychological experiences when carrying out duties were categorised as follows: fear of the unknown disease and fear of contracting COVID-19.

5.4.3.1 Sub-theme: Fear of the unknown disease

Most of the participants indicated that fear gripped them because no one knew much about the disease. Most participants concurred that information pertaining to COVID-19 was scant. The following excerpt outlines this:

"For me as a professional nurse, initially it was very scary because this was an unknown virus. The cause to me was unknown. I was fearful… I was very fearful and nobody not even health authorities knew what was going on. So, you were getting one directive and the next week the directive was changing. This week

they would say it was not an airborne, and the next time it was airborne so, it was a learning experience from the very beginning." (A6A)

The lack of information around the transmissibility of the virus added more to the fear that respondents had at the time. No one knew how the virus was transmitted from one person to another, as there were many theories flying around at the time. IPC protocols kept changing, and for a brief moment it appeared as if people were unaware of what to do to curb the spread of the virus to healthcare workers. Hence, everyone was scared of contracting the virus and becoming another statistic in the isolation ward. One participant had this to say about working in the radiology department during the pandemic:

"In the beginning it was scarier than anything else because no one knew what to expect, as it was the first time that I experienced a pandemic…even management could not give us clear instructions on exactly what to do. I got my first positive COVID-19 patient, and I was just told by management that I just need to go forward, even though I did not have proper PPE… this was in the beginning when no one knew anything about the virus." (C4A)

On the other hand, some of the participants were afraid, although they had information on the spread of the disease. The following statement confirms this:

"Knowing that the COVID-19 is easily spread, and after having COVID-19, you have got to get conscious, it is in the air, that is the scary part, when the patients have come in, and they are going to be in our department all through." (A3A)

However, this was not the same for all participants. One radiographer had the following to say:

"I know everybody else was very scared, but I was not scared. In fact, when the first patient came along, I volunteered to do it myself and if any other COVID-19 outbreak occurs, I would volunteer to pioneer, I also want to be experienced and go and do these things. I have never feared infections." (D10A)

The lack of information only increased fear and paranoia amongst healthcare workers since they were working amid the virus daily. Participants felt the health system was not prepared for the pandemic, as evidenced in the following excerpt:

"…. so, in the radiology department, especially with COVID-19, right, in terms of safety, look, not everyone was adherent initially to wearing a mask and to social distancing. The patients that were coming here from the wards they were not screened, they had no masks, they were all in the waiting room together, and…our department does not have adequate ventilation, everyone is in a confined space…I was quite apprehensive and concerned and we were at very high risk of contracting COVID. Things like also doing the ultrasound (scan) in very close contact with the patient and we have no screens." (B2A)

In contrast to the view that departments did not have adequate prevention measures in place, some participants believed that new IPC measures were implemented within their departments. These measures aimed to preserve the health and safety of the employees. A frontline radiology staff member in a managerial position had the following to say:

"Yes, it has been a struggle, but I think we have things to make our department as safe as possible…Safety is a concern, I would say, because the virus is still around but I feel the hospital and the radiology department, put measures in place to try and protect us. So, even though the concern is there, but it is not that much because we have, for instance a book where we all sign, we all document the temperature, and you declare if you have COVID-19 symptoms. We also have screening tools in our department. We attend to the COVID-19 patients after lunch, we know that we can clear them. So, we close the department, clear the patients before bringing any COVID-19 patients to our department." (B1A)

Despite this, one participant had the following to say:

"Yes, they now provide PPE but I still do not feel 100% safe … my honest feeling in my workplace as a front care worker is that I do not feel safe." (C2D)

5.4.3.2 Sub-theme: Fear of contracting COVID-19

Almost all of the participants described how fear gripped them. This occurred when COVID-19 started claiming casualties in the hospitals where they were working. One participant's response captures the fear that gripped radiographers at the time:

"…. it came in very challenging. It left almost everyone very terrified … I remember how we would be fighting among ourselves to say I will not go to the COVID-19 ward because they needed Bedside Unit (BSUs) x-rays there … why do we have to go; we cannot go; we will not go; we will die." (C2D)

Most of the radiographers and some radiologists demonstrated fears of contracting COVID-19 when attending to confirmed COVID-19 patients. One radiographer had the following to say:

".... it does not make me comfortable x-raying a COVID-19 patient, considering how fast it is spreading, considering the condition of the patients. We see a lot of these patients. So, it does stress me out that these are the things that we are being told in our workplace. And a lot of people in the past have become COVID-19 positive. So, you do get stressed and scared about the condition." (C3A)

One of the radiologists echoed the same fears as outlined in the following excerpt:

"…. and from the radiography side of things, lots of anxiety dealing with these patients…. from my side a little less, because remember my interaction is a little less." (B6A)

Participants also expressed concerns around those patients thought to be negative but presenting with x-rays aligning with COVID-19 presentation, as noted in the excerpt below:

"…. a little bit of fear with regards to patients that were thought to be negative, but we find x-rays that are not..." (B6A)

However, some radiographers were not afraid to conduct their duties when attending to COVID-19 patients. This was due to their past experience working with patients with infectious diseases, as well as their resilience, as outlined in the excerpt below:

"I do think in the beginning, I did feel quite unsafe, but now that we have progressed, it is to the point like you are still being careful, but it has sort of become a normal thing…the way you attend to a COVID-19 patient has just become like how you would almost treat a CRV (Community respiratory virus) patient… so you are not as intimidated by patients with COVID-19 anymore." (D9A)

The majority of the participants related to how fear gripped them when COVID-19 started claiming casualties in the hospitals where they were working. No one knew much about the disease, and the rate at which infected people were dying was scary. Not much was known about the disease, and all the participants concurred that information pertaining to COVID-19 was scant. The lack of information about the virus in the early phase of the pandemic made it even worse. People were not sure if they were doing the right thing to keep themselves and others safe. The following participant's response captures the fear that gripped some radiology staff at the time:

"So, from the beginning that I mentioned earlier on, I did not feel very safe. I felt the honest truth is that you can never be too careful about infection. You know you will live in fear and always be asking yourself; did I not touch myself? Did I wash my hands very carefully? Did I wear that mask properly? Because you

know what, you may have had a mask, or you might have washed your hands, but it also goes down to whether you wore your mask correctly or not. That is the reality so you will have anxiety every time you come back home." (C2D)

Additionally, some of the radiology staff panicked when attending to PUIs due to uncertainty around the patient's COVID-19 status. A participant had the following to say:

"Obviously when things settled down there was anxiety with patients coming in… I still had to interact with the COVID-19 PUI, but a lot of our doctors were good enough to say let us wait for the PCR. Let us not deal with this urgently. That helped." (B6A).

5.4.4 Theme: Impact of COVID-19 on emotional well-being

Mental health was greatly affected during the pandemic. Anxiety gripped a significant proportion of respondents during their day-to-day duties, especially when attending to confirmed COVID-19 positive patients. Under this theme, the following sub-themes emerged: emotional strain and mental health challenges.

5.4.4.1 Sub-theme: Emotional strain and mental health challenges

Fear manifested as anxiety, stress and emotional strain. Also, a number of frontline radiology staff indicated that the experience was emotionally traumatising and exhausting. The pandemic hit the shores unexpectedly, resulting in anxious moments within radiology departments. This was due to a lack of laid-down IPC protocols to ensure the safety of practitioners. In the early days of the pandemic, the majority of patients filling up hospitals were classified as PUIs. When the results of these PUIs came back positive, they were then admitted into COVID-19 wards, where visitors were not allowed. One participant had the following to say:

"It has been very stressful (pause). It is stressful and it has been very stressful working in the environment. From the first time that it first started. You are

strained. You are stressed emotionally, physically, mentally as well. It is just a draining on you. It is just draining overall." (C3A)

Lack of adequate information about the disease, coupled with shortages of PPE, caused most radiology staff to fear contracting the virus and becoming another statistic in the isolation ward. The increasing rate of infection among colleagues heightened the fear of individual infection. One participant had the following to say:

"It is also scary when your colleagues are testing positive because you have spent time with them. When many colleagues are testing positive, and you know that they got this infection from work because working arrangements here are sometimes not safe – the arrangements are not really that good." (C2D)

Radiology staff from various professional levels felt they were not professionally recognised by other health disciplines and management. This was despite being in constant contact with both PUI and COVID-19 patients at different stages of their health management. Unawareness of the role of radiology staff by other disciplines and management resulted in inadequate provision of PPE. This happened because they did not consider radiology staff as frontline healthcare workers. This demoralised some staff. One radiographer had the following to say:

"Impactful in the sense that radiography as a profession is not really well recognized. Sometimes you will even fight for a mere mask or PPE because they say it is only given to the frontline workers. Radiographers were not being included as frontline workers since they were saying you cannot be a front worker because when a patient comes into radiology they would have already passed through a medical officer or a nurse in trauma who would have assessed and classified them as a PUI or not … honestly, it is very exhausting to always be explaining what you do while for other professions it comes easy. For example, if you are a nurse it is going to be easy for you to get protective

gear (PPE). If you are a doctor you are going to get it as well but if you are a radiographer, you need to go there and explain first." (C2D)

A radiologist also echoed similar concerns as outlined in the following excerpt:

"I am talking about outside the department, that we are a department at risk because we see nearly every patient. It was not really recognised at the beginning that we are. We were not triaged as significantly at risk, it was a little bit offensive, I felt." (B6A)

Additionally, the radiology staff felt that management did not take their health safety into much consideration. Most protocols seemed to focus only on speedy service delivery for the patient at all costs. This is outlined in the following excerpt:

"…. hospital management felt that closing the department is delaying patient's management. So, now it is like your life does not really matter, as long as you are there to attend to the patient …my honest feeling in my workplace as a front care worker is that I do not feel safe." (C2D)

Staff with underlying medical conditions felt anxious about working in close contact with the virus. They also felt that management did not put effort into considering their health and the implications of exposure. A participant had the following to say:

"…. so, from a personal anxiety point of view, I did not think management appreciated the level of immunosuppression I was at." (B6A)

The fear of contracting COVID-19 in the workplace was emotionally draining for most respondents. This was exacerbated when some staff members succumbed to the virus. Mental health was greatly affected during the pandemic. Anxiety gripped a significant proportion of respondents during their

day-to-day duties, especially when attending to confirmed COVID-19 positive patients. One participant had the following to say:

"Anxiety was bad with the first wave. So, yes from a personal side the anxiety had its moments. Psychologically I think I probably experienced the same things others have, the isolation, a lot more isolation for me because I did not really go visit the other wards..." (B6A)

The radiology staff also suffered from paranoia when attending to COVID-19 patients. The constant thought and doubt about whether one had let one's guard down while attending to a PUI or COVID-19 patient throughout the day was widely reported among the radiology staff. This is exemplified in the following excerpt:

"…. it is traumatic… you always live in anxiety…You know you will live in fear and always be asking yourself; did I not touch myself? Did I wash my hands very carefully? Did I wear that mask properly? ... so, you will have anxiety every time you come back home... You are not really sure about what happened when you were with the patient…in the particular COVID-19 ward…. Whatever you do, you will still have that anxiety and be asking yourself did I or did I not?" (C2D)

However, the mental challenges were not only a result of fear or paranoia towards the virus but also from the stress of seeing patients' health deteriorate by the time elective cases were rearranged. A particular radiologist had the following to say:

"…. at the beginning, with the initial lockdown, we cut on our elective work…What we have seen is the consequence of that this year where our malignancies are coming back at a higher stage disease and that's a bit distressing. I feel like we could have done better. Obviously when things settled down there was anxiety with patients coming in. We had to deal with their anxiety as well." (B6A)

Unexpectedly huge salary cuts in private radiology practices due to reduced patient numbers during lockdown exacerbated the ongoing stress among staff. One radiographer had the following to say:

"…. it was a very big salary cut… it was scary. It was very bad. Initially, they told us there are no salary cuts and not to be alarmed and then, when it came towards pay day, we were just told we are getting a salary cut and then…the first month I had like 30% and then, the next two or three months, I had 50% salary cut." (D9E)

5.4.5 Theme: Impact of resultant mental health status on professional competence

Emotional strain and mental health challenges experienced by the frontline radiology staff impacted their professional competence, specifically the following aspects (sub-themes): attendance, physical endurance, patient care and interaction and adherence to protocols.

5.4.5.1 Sub-theme: Attendance

In an environment without proper support structures to manage such occurrences, most mentally vulnerable practitioners grew to loathe going to work, as they perceived the workplace to be a danger to their health. Resultantly, absenteeism occurred via exempting themselves by 'calling in sick' or requesting extended sick leave from their doctors. One participant had the following to say:

"You feel tired. You are exhausted, mentally you are not sick, mentally you are tired. You do not want to go there (you do not want to go to work), because of your fear, you call in sick …Working within a COVID-19 environment has made me lose interest in my job in a way …professionally, I am losing interest in clinical radiography on a daily basis. We are all wishing and pushing for us to perhaps move to either academia or get a senior position where you do not attend to patients - you will just be in an office. This is because of the risk of

your safety and what is happening around your life. Perhaps one can move to a different field where you will not be in contact with the patient. So, it has affected me personally on my mental state because of anxiety." (C2D)

Additionally, staff shirked work responsibilities and duties due to the mounting anxiety, fear and paranoia of attending to PUI and COVID-19 positive patients. The following excerpt expands on this:

"I remember how we would be fighting among ourselves to say I will not go to the COVID-19 ward because they needed Bedside Unit (BSUs) x-rays there. So, people were saying why do we have to go; we cannot go; we will not go; we will die. If maybe there is a COVID-19 Patient Under Investigation (PUI) or maybe COVID-19 confirmed case coming down to the department for CT or x-rays, we would run away. We would not even want to come back." (C2D)

In addition to IPC protocols limiting the number of patients accessing radiology facilities, the frontline radiology staff's fear of increased exposure to the virus while attending to PUI or COVID-19 patients also contributed to the reduced numbers. A participant (radiologist) had the following to say:

"…. Obviously, now we are a bit more wary and more cautious in terms of walk-in patients. We do not attend to as many walk-in patients because apart from the concern for ourselves it is also the concern for the radiographers and for the other patients in the department. So, normally we would, just say yes to almost every radiology request and do it as per normal and do it immediately, but now we have to see if the patient is COVID-19 negative or COVID-19 positive. Or if the patient is not tested then we will not do the radiology exam. So, it has impacted on the number of cases that we have been doing and the type of cases as well." (B2A)

5.4.5.2 Sub-theme: Physical endurance

Radiography is a physically demanding job, as staff spend significant time on their feet, carrying image receptors, and physically positioning patients. Due to contracting COVID-19, some participants complained of reduced physical endurance as outlined in the following excerpt:

"The major implication was contracting Covid-19. And since then I have not been a hundred percent. Like, I get tired quite frequently than I used to." (C4A)

5.4.5.3 Sub-theme: Patient care and interaction

Radiographer-to-patient interaction, as well as radiologist-to-patient interaction, was negatively affected by the pandemic. A significant proportion of radiographers and radiologists reported that they reduced the time of speaking to patients during the pandemic as compared to pre-pandemic times. This was a conscious mental decision to limit the contact time with patients so as to reduce the chances of contracting the virus. Additionally, due to increased fear of contracting the virus and awareness of the effectiveness of social distancing, radiology staff consciously reduced physical contact with patients. They did this to lower the chances of contracting the virus from an infected individual. One participant had the following to say:

"Just get there, do the x-ray and get out as fast as possible." (C5B)

5.4.5.4 Sub-theme: Adherence to protocols

The seemingly endless emotional and mental roller coaster was caused by mounting fear, anxiety, paranoia, and stress. This resulted in some of the radiology staff becoming fed up with following the strict and volatile IPC protocols. Resultantly, some radiology frontline healthcare workers let their guard down from time to time. A participant had the following to say:

"…. and then you know as we progressed, I think everybody is at the stage where they are sort of, kind of, fed up a little bit, and you maybe tend to let your guard down when you should not." (D9A)

5.4.6 Theme: Coping strategies

During all of this, the frontline radiology staff consciously or subconsciously adapted coping mechanisms. These helped them manage the stress and challenges they faced daily while working during the COVID-19 pandemic. However, no participant ever sought professional help to cope with mental health issues during the pandemic. Under this theme, the following sub-themes emerged: emotion-focused, problem-focused and barriers to coping.

5.4.6.1 Sub-theme: Emotion-focused

To cope with the challenges faced while working in the radiology department during COVID-19, some of the frontline radiology staff turned to the emotional side of things to cope. Participants implemented emotion-focused coping strategies such as accepting professional responsibility and duties. In keeping with this, participants accepted that their professional career involved working with different types of patients under unfavourable conditions, pandemics included. This acceptance of roles and responsibilities kept them motivated and helped develop endurance. One participant had the following to say:

"I just think it is our job at the end of the day. So, we have to do it. And yes, we just have to. And then you just pick yourself up and you motivate yourself to move forward and think that you know what, okay, you need this, this is your job at the end of the day." (C3A)

Other frontline radiology staff found consolation from colleagues and family (social coping). Spending time with family members, having a good laugh with colleagues or chatting about their experiences as co-workers helped them cope with mental health issues during the pandemic. The following excerpts exemplify this:

"…. but now people talk about it, we do joke about it. We tried within our department. We have our departmental WhatsApp group that sometimes goes berserk because somebody is highly anxious or they have heard something or they have had to do too many BSUs. Pretty good, yes. Our interpersonal relationships within the department have helped to ease a bit of the anxiety. Anxiety was bad with the first wave. I see it is a lot calmer now." (B6A)

"I just want to go clean up and soak other clothing or soak myself in a bath tub and be with my family." (D10A)

Additionally, some frontline radiology staff implemented appraisal-focused coping by accepting the situation, mentally adapting and building resilience to endure the challenges. The excerpt below outlines this:

"I knew mentally I was quite strong, that if you wipe up and if you sanitise, if you wear the correct PPEs and you follow protocols, then you will not be infected and, I think, that carried me through all the waves… people are so used to the presence of COVID-19. So, now we visit them (family) but we take extra precautions and we know that by changing this, you could be okay." (D10A)

In some instances, psychologists were available for employees to engage with them to deal with mental health issues during the pandemic (psychological counselling). The following excerpt exemplifies this:

"We had psychological support at one point when the stress level was too high. We had our psychologist come in to discuss in a group…It was a psychologist in the hospital." (B6A)

Other participants reported finding solace in prayer and having faith in God to guide them through the pandemic (spiritual therapy). This is outlined in the excerpt below:

"…. what has kept me going is prayer and faith in God. Yes, seriously prayer and faith in God has kept me going" (C6A)

5.4.6.2 Sub-theme: Problem-focused coping

Other frontline radiology staff focused on practical ways of dealing with the challenges presented during the COVID-19 pandemic as a way of coping. They adapted their behaviour and state of mind towards attending to PUI and COVID-19 patients (adaptive behavioural coping). Others sought occupation-focused solutions to address the challenges arising on a day-to-day basis. One participant had the following to say:

"…. we were practical in our approach to it and therefore even though there was shortage of PPE we were not short, because we worked around the issue…You cannot say… we have got no PPEs, we cannot x-ray patients. You have to have a proactive mind and use some logic and work around that. I think, we found out practical solutions and, yes, there was a strain of the other staff that they were a bit afraid and intimidated, but I did not feel intimidated." (D10A)

The introduction of the COVID-19 vaccine brought hope for the staff. This hope helped them cope during these times, as outlined by the following excerpt:

"Yes, definitely I am no longer scared. Especially now that I am vaccinated also." (C4A)

Activities such as walking by the beach, exercising, and reading were some coping mechanisms participants used to manage mental distress during the pandemic. This is illustrated by the following excerpt:

"…. I feel that exercise has helped me. While, I was into exercise before COVID-19, during COVID-19 I invested in home exercise and fitness stuff to go in. Obviously, I learned all exercises as being great to your mental health but, I

mean, it is not everything. Other things that I enjoy is reading, it just helps me disconnect from what is occurring around me, in a positive way, and, just trying to learn more, yes. I know I sound like a nerd, but I feel like the more you know, the more powerful you are and the more control you have over the situation. So, if you stay above the problem, you will not have a problem." (D10B)

5.4.6.3 Sub-theme: Barriers to coping

Despite their coping efforts, frontline radiology staff experienced barriers that hindered the success of their efforts. These barriers fell into four main categories: work-related, lack of support or recognition, personal factors and colleagues. Work-related barriers involved challenges faced within the departments that continuously put pressure on the radiology staff despite their coping efforts. These included staff shortages and the working environment. Staff shortages were experienced in both public and private radiology departments. One participant had the following to say:

"…. staff shortages that I mentioned earlier. The fact that there is only one x-ray room, one x-ray machine, there is no BSU, or any other model. So, they think one person is enough to cope." (C4A)

Failure and non-approval of strategies proposed by frontline radiology staff, due to negative influence from other departments, acted as a barrier to their coping efforts. This is exemplified by the following excerpt:

"…. one thing we tried to do was we had to have a roster to limit the number of people in that small reporting room at a time, and unfortunately that did not work. Even though we have people to do that there were complaints from other departments saying that everyone has to be at work." (B2A)

Radiology staff ranging from public to private practice lacked support in their coping efforts and felt there was no recognition of the heightened risk of exposure to the virus for those with existing co-morbidities. Participants looked forward to the vaccine as an aid in coping with the ongoing risk of exposure in

their place of work. However, they felt management did not put enough effort into ensuring accessibility of the vaccine for their employees as outlined in the excerpt below:

"So, from a personal anxiety point of view, I did not think management appreciated the level of immunosuppression I was at. Accessibility to the vaccine was poor on our side, so we were hearing about other hospitals where everybody was vaccinated, right down to the security and the porters and we were still waiting." (B6A)

Most radiographers felt that non-recognition and lack of support from management presented an ongoing barrier to all their coping efforts. The lack of recognition led to exclusion from all departmental decision-making. As frontline healthcare workers in daily contact with patients, radiographers felt they needed to have a voice, rather than simply receiving ever-changing IPC protocols imposed on them. The following excerpt exemplifies this:

"In all honesty, if you have never x-rayed a COVID-19 patient, you will never understand how stressful and how anxious you get…management will never understand that and that is why they make these rules or come up with these policies and stuff that just do not help us in any way." (C2C)

Private radiology departments felt that salary cuts presented the main barrier. This was because the cuts left all their coping efforts in vain. Financial responsibilities required monetary support from management. One participant had the following to say:

"So, apart from them being very supportive, the only downfall between me and work was the major salary cut." (D9E)

Additionally, inconsistencies in IPC implementation created an additional barrier, as outlined in the following excerpt:

"For me, the biggest barrier is management because protocols that are drawn every time do not seem to have you as a radiographer in mind … the issue why we close that department (CT scan) but not the other (x-ray) …Then they (management) will change the protocol. If they close for two hours (CT scan department) and you are working there, you are safe but when you come tomorrow they change." (C2D)

Other frontline radiology staff were of the opinion that personal factors were creating barriers to their coping efforts. These factors included uncontrollable anxiety and not being able to open up emotionally. They also involved strained family relations due to reduced interaction with family members. Additionally, individuals within society who did not adhere to national IPC protocols contributed to these factors. Some of these individuals believed that COVID-19 was not real, but rather fictional. One radiologist had the following to say:

"I think it is personal anxiety that you cannot really manage..." (B6A)

A radiographer based in private practice had the following to add:

"Yes, and also not seeing family was a very big challenge for me, because I am very close to my family and they live in a different town, that was very hard for me. It does get a little bit lonely…then on the flip side you get the people who think that there is no COVID-19. For me I think that has probably been one of the biggest pushbacks, those people who think that it is not a real thing, they do not have to wear the masks..." (D9A)

Other frontline radiology staff felt some of their colleagues were a barrier to their coping efforts. This was because they passed negative energy within the team, leading to more stress among mentally vulnerable colleagues. A participant had the following to say:

"…. there was a challenge in trying to keep a strong mind-set of the staff. Some of them were overwhelmed…So, I think, the barrier was in terms of the

challenge of the staff, trying to change the mind-set of the staff was… very difficult and they needed constant reassurance." (D10A)

5.4.7 Theme: Intervention for mental health effects

The frontline radiology staff perceived the following sub-themes as interventions that helped address their mental health challenges during the COVID-19 pandemic: emotion-based interventions, problem-based approaches, support-based interventions and availability of space or platform to vent.

5.4.7.1 Sub-theme: Emotion-based interventions

Participants were of the opinion that talking to a qualified practitioner one-on-one through psychological counselling provided a healthy channel to relieve stress, anxiety and help with their mental health during the pandemic. Other radiology staff perceived social interaction and support from family and spouses as a strong pillar that provided interventional support during the pandemic. Furthermore, other frontline radiology staff thought that the availability of spiritual support or allocation of time for spiritual intervention was quite useful. Participants had the following to say:

"I told the staff, 50% of your battle with COVID-19 is won by wearing the correct PPEs and by washing. The other 50% come from your faith in prayer and God. We sort assistance through our Human Resources (HR) system. So, if you need psychological support, any emotional, mental strain you are going through, we had a system where the staff could anonymously contact that call centre and they would provide the support for the staff.… also I just want to go clean up and soak other clothing or soak myself in a bath tub and be with my family." (D10A)

5.4.7.2 Sub-theme: Problem-based approaches

Other frontline radiology staff perceived problem-based approaches as practical solutions to the challenges encountered. These interventions addressed the difficulties faced during the COVID-19 pandemic. The solutions included strategies to curb staff shortages, salary cut relief, and strict adherence to IPC protocols as a means of self-protection from contracting the virus. This is exemplified by the following excerpt:

"…. eventually, when they decided to put all the staff back on shift, I hardly did any more COVID-19 patients. I would scan them, but someone else would be the contact person…and then, eventually when we were getting a full salary, everyone came onto shift. It felt like work went really smooth there, to be honest. So, workload was not too much. We did have most of all the shifts covered and people always helped... I sanitised, washed my hands after and all of that between and after every patient." (D9E)

Other solutions comprised inclusion in decision-making in IPC protocols in radiology settings. They also included improvement of ventilation to mitigate the spread of the virus. Additionally, re-strategising shift rotations would minimise staff exposure to the virus. One participant had the following to say:

"The ventilation system has not improved yet because they will need to install an extractor fan. So, we are hoping that that will help with the virus … the D-germ lights extracts the virus quicker…. we needed to design a shift where radiographers do not need to mix so as to minimize cases of cross infection among colleagues … They needed a shift where this group is working, the other group is not working so that we can still have another group to carry on and provide 24-hour service." (C2D).

5.4.7.3 Sub-theme: Support-based intervention

Radiology staff perceived support-based intervention in the form of motivation and support from management and colleagues as valuable interventional

strategies that addressed challenges faced during the COVID-19 pandemic. One participant based in a public healthcare institution had the following to say:

"I would think as management, they should try and motivate us more in terms of like, just give us more motivational talks more often, and encourage us and ensure that you know what that we matter as well, in this pandemic. And that our hard work does matter and the things that we are going through the stress and the emotional stress and the tiredness that we feel that it is appreciated at the end of the day. Because we do not get that from management." (C3A)

Motivation and support from management included recognition of efforts and provision of coping support. It also involved constant checking and cheering on of staff, circulation of motivational material, and updates on COVID-19. Although not being practised, participants believed that salary cut relief would have demonstrated support. They also felt that recognisable efforts by management to source and provide adequate PPE for frontline radiology staff would have shown support. The following excerpt from a radiographer based in private practice exemplifies this:

"Management giving us PPE and checking my vitals …also did make some small cheer me ups at work and they would buy us cake now and then. Just to encourage the staff or even we received emails to say thank you. They were very grateful that we put our lives at risk during COVID-19. So, apart from them being very supportive, the only downfall between me and work was the major salary cut…eventually, when they decided to put all the staff back on shift, I hardly did any more COVID-19 patients. I would scan them, but someone else would be the contact person." (D9E)

Frontline radiology staff perceived life outside work to be a valuable asset in intervening during the COVID-19 challenges. This involved creating a work-life balance that allowed staff to have quality time with family, maintain constant communication with family and friends, as well as interacting with outsiders going through a similar experience. One participant had the following to say:

"Even like the family, they would always constantly phone in and check-up…I had very good support from family and at least once a week I get a phone call from them…to get through everything. I have got my husband who is also in the medical field…we have got a lot of friends in the medical field as well, so I have got a lot of support from them…people who I can speak to outside of work that can relate because they are also going through the same things as well. We sometimes even almost joke about certain things, you know, just to make life endurable..." (D9A)

5.4.7.4 Availability of space or platform to vent

Other frontline radiology staff perceived the availability of space or platform to vent within the workplace as a valuable intervention. This helped address mental challenges faced during the COVID-19 pandemic. It involved creating platforms to allow constant communication with colleagues. These platforms included informal means, such as WhatsApp, providing an opportunity for venting with individuals sharing the same experience. A participant had the following to say:

"We tried within our department. We have our departmental WhatsApp group that sometimes goes berserk because somebody is highly anxious or they have heard something or they have had to do too many BSUs." (B6A)

5.5 SUMMARY OF THE CHAPTER

This chapter has comprehensively presented the experiences of frontline radiology staff during the COVID-19 pandemic. These experiences are organised into seven overarching themes and their associated subthemes. This organisation follows data analysis conducted using the IPA framework in the preceding chapter. The first theme explored their duties and roles, highlighting the use of radiology modalities and the specific responsibilities of radiologists, radiographers, and nurses. The second theme addressed personal and work-related challenges, including unpreparedness, increased infection risk,

adaptation to new protocols, physical health concerns, financial difficulties, social shielding responsibilities, and disrupted social relations.

Emotional and psychological experiences, such as fear of the unknown disease and fear of infection, were detailed in the third theme. The fourth theme examined the emotional strain and mental health challenges impacting their well-being. The fifth theme connected these mental health effects to professional competence, focusing on attendance, patient care, and protocol adherence. Coping strategies, both emotion-focused and problem-focused, were discussed in the sixth theme, along with barriers to effective coping. Finally, the seventh theme outlined interventions for mental health effects, including emotion-based, problem-based, and support-based approaches, as well as the importance of providing space for staff to express their feelings. This chapter contributed towards research questions 1-7, which will be fully addressed in the subsequent chapters by discussing the findings and developing support strategies based on the findings.

CHAPTER 6: DISCUSSION OF FINDINGS

6.1 INTRODUCTION

Unexplained findings often leave an incomplete puzzle (Kitchin 2014). Therefore, this chapter will connect the preceding chapters by discussing and interpreting the current research findings. These will be discussed according to the study's theoretical framework, which is grounded in the modified Transactional Model of Stress and Coping, incorporating the Health Belief Model and Attribution Theory. Additionally, the position of the findings in relation to existing literature and the adapted theoretical framework will be established.

In this chapter, the researcher's own positionality is critically examined, acknowledging the value-laden nature of the study. This reflexive stance ensures that the interpretation of findings is both informed by and transparent about the influences of the researcher's background as a healthcare worker during the pandemic. The researcher's arguments are presented to situate the findings within a broader narrative, balancing the voices of participants with theoretical and empirical insights.

6.2 PARTICIPANTS' DEMOGRAPHIC CHARACTERISTICS

In line with the principles of interpretative phenomenological analysis (IPA), a maximum of 15 participants is recommended. This allows the researcher to manage the data and engage deeply for detailed analysis (Pietkiewics and Smith 2014). Phase 1 of data collection involved 13 participants. They took part in one-to-one semi-structured interviews. This approach aligns with previous phenomenological studies. For example, Brymer and Schweitzer's (2013) exploratory study on the search for freedom in extreme sports recruited 15 participants. Another example is Hall, Chai and Albrecht's (2016: 136) study, which involved recruiting ten teachers as participants. The two focus groups conducted during Phase 2 of data collection consisted of five and six

participants, respectively. This was done in accordance with Nyumba *et al*. (2018) and to allow the researcher to capture the unique voices of each participant. Phenomenological studies seek to explore the lived experiences of participants and their interpretation of these experiences (Smith, Flowers and Larkin 2022). This is a time-consuming process that requires the researcher to engage closely with the data to establish these experiences (Smith, Flowers and Larkin 2009). As such, it challenges the orthodox linear relationship between sample size and the value of research (Reid, Flowers and Larkin 2005).

The study sample was made up of 24 participants constituting two radiology nurses, four radiologists and 18 diagnostic radiographers working at public and private radiology departments in the eThekwini district of KZN. This aligned with the ratios of these professionals within radiology departments where only a few radiology nurses are allocated based on need. Only a few radiologists are working in these departments due to the nationwide shortage, thus impacting the workforce in condensed workloads (Mkhize *et al*. 2022).

The focus groups consisted of radiographers due to diverse working patterns among other professions, and also to accommodate radiographers who made up the majority of the population within the radiology departments. Hence, aligning with Mkhize *et al.*'s (2022) statistical data collected between 2002 and 2019. Most of the participants are working in public radiology departments since the government is the main employer of healthcare professionals in South Africa, as highlighted by George, Quinlan and Reardon (2009). Ahmat *et al.*'s (2022) findings also support this by indicating that 85% of healthcare workers in African countries are employed within the public sector. Despite potentially lucrative salaries in the private sector, the majority of healthcare workers prefer to work in the public sector. Reasons for this choice include job security and benefits such as extended medical aid allowance to family. Other benefits include housing contributions and favourable pension funds worth 40% of their salary (Mumbauer *et al*. 2021).

However, for the radiologists, the distribution is different. Statistics indicate that 0.48 radiologists per 100 000 population are employed in the public sector, while 4.65 per 100 000 work in the private health sector, despite the public sector being the healthcare provider for the majority of the population (Wishnia *et al.* 2019). This trend can be attributed to the competitive market in private healthcare, in contrast to the public sector, where there are infrastructure and consumable shortages, adds Wishnia *et al.* (2019).

As a researcher and radiology staff member who worked for several years within the eThekwini district, including a portion of the COVID-19 pandemic, the researcher views this demographic distribution of participants as a mirror of the structural and operational realities of South Africa's healthcare system. For instance, the predominance of public sector workers in the sample aligns with the healthcare workforce's employment trends in South Africa, where public institutions serve most of the population despite chronic resource limitations (Wishnia *et al.* 2019). This demographic data is important for contextualising the lived experiences of the frontline radiology staff during the COVID-19 pandemic. This is because the challenges faced in each healthcare setting, i.e. public or private, could potentially directly shape their mental health and coping mechanisms in accordance with the TMSC.

Most of the participants are possibly breadwinners as suggested by the dominating age ranges of 18-49 within the sample. This aligns with national statistics which indicate that South Africa's biggest workforce is within the 25-54 age group (OECD 2020). The current findings could imply that a significant portion of the sample was relatively early in their careers. Younger professionals might have experienced the pandemic differently compared to those who were more senior. They were possibly more adaptable to changes in work protocols. However, they were potentially more vulnerable to mental health challenges. This vulnerability could be due to their limited experience in coping with such high-stress situations. Furthermore, younger healthcare workers may have faced heightened fears about their own health and career development during the pandemic.

The significant number of female participants (n=18; 75%) corresponds with SANC (2019), which indicated that the majority of nurses are female (91.4%) and 83% of radiographers are female (Mkhize *et al.* 2022). International statistics also reported that 67% of health workers worldwide are female (WHO 2023). However, compared to data collected in the past, these statistics indicate a growing increase of male counterparts in both the nursing and radiography fields due to changes in the professional industry (SANC 2019; Mkhize *et al.* 2022). Locally, this is also being influenced by the KZN DoH's Employment Equity Target (EET), which often indicates preference for male applicants in most vacancies (Department of Public Service and Administration 2023). The sample's male: female ratio of radiologist participants (1: 1) does not correspond to national statistics that indicate that the vast majority of specialists in private and public healthcare sectors are males (Wishnia *et al.* 2019). However, the generalisations of the statistics might not be directly reflective of the situation on the ground in smaller geographical locations.

The significant number of Grade 1-3 radiographers in the sample reflects the central role of radiology staff during the COVID-19 pandemic, especially given the increased use of imaging in diagnosing and managing COVID-19 patients (Kwee and Kwee 2020; Rousan *et al.* 2020). The presence of radiologists and a clinical head of department further supports the comprehensive exploration of perspectives across different levels of responsibility and authority within the radiology department. Those in senior positions may have had additional administrative stressors, while junior staff might have focused more on direct patient care and the emotional toll of working in high-risk environments.

According to the DPSA (2018), the South African public service operates a salary scale based on Occupation Specific Dispensations (OSDs). This scale uses a grading system from grade 1 to grade 3. The grades reflect the employees' level of experience within their seniority ranks. These ranks include radiographer, chief radiographer, chief radiographer (supervisory), assistant director, and deputy director. In the public sector, radiographers start at grade 1 after graduation and registration with the HPCSA. From there, they progress

up the scale to managerial and clinical leadership positions (DPSA 2018). However, due to limited opportunities for leadership, career and professional development within the South African radiography sector (Thambura and Amusa 2016), only a few progress to chief radiographer and radiography manager status (assistant director and deputy director). This results in a significant number of radiographers within the Grades 1-3 bands. Participants in these bands constituted 66.6% of the overall radiography staff in the sample. However, this does not compare with European systems such as the UK, where there are diverse opportunities for progression. There are more specialities, such as reporting and consulting, which do not currently exist in Africa (Society of Radiographers 2022).

The participants' work experience ranged from two to over 20 years in their current roles, with the majority falling within the 6–10-year range. This suggests that most were likely familiar with their departmental protocols and environment (Ashley-Roberts 2023), potentially reducing the risk of negative experiences caused by unfamiliarity. However, during the COVID-19 pandemic, the clinical radiography workforce had to adapt to newly introduced protocols, many of which had not been used previously. In some cases, they had to work in specialised COVID-19 units that represented unfamiliar environments. Therefore, although these participants were used to the routine demands of their roles, the pandemic introduced new stressors and challenges, which may have significantly influenced their coping strategies and emotional well-being.

With regard to the number of COVID-19 patients attended to per week, since (n=21, 87.5%) of the participants were directly in contact with COVID-19 patients, the majority of the participants attended to between one to more than 20 patients per week. This was because most participants were involved in the clinical duties of a radiology department. Additionally, this indicates the magnitude of the COVID-19 workload that was handled by these departments during the pandemic. This echoes the reported increases in radiology workload internationally (RANZCR 2020; Akudjedu *et al.* 2020; Elshami *et al.* 2021; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022). Thus,

confirming the significance and role of radiology in the management of COVID-19 patients (Kwee and Kwee 2020; Yu *et al.* 2020). A higher proportion of participants were involved in clinical settings with direct exposure to COVID-19 patients, which likely contributed to heightened stress, emotional strain, and fears related to contracting the virus. Participants in clinical settings were probably more affected by work-related challenges, such as adaptation to rapidly changing protocols, than those in non-clinical roles. This may explain the substantial psychological impact and the varied coping strategies explored in the study.

In alignment with Wishnia *et al.* (2019), most of the South African population receives healthcare from the public sector. The majority of the COVID-19 patients mentioned in this study attended public radiology departments. Specifically, they went to the tertiary institutions within the district. This was because they were offered either free or affordable healthcare within public hospitals. The cost depended on their age and residential status in South Africa. This system is based on the South African public healthcare system (Modisakeng *et al.* 2020).

Other countries saw residents drown in COVID-19 healthcare-related debt, as there were no provisions for free medical care. Healthcare arrangements in other setups, for example in the USA, required patients to pay for their healthcare regardless of it being a pandemic (Wapner 2020). However, as indicated later in this discussion, despite the availability of affordable healthcare in public health institutions in South Africa, some patients still preferred to seek medical care from private institutions. This was due to perceived limitations, backlogs, and poor service delivery within the public healthcare system (Wishnia *et al.* 2019). Hence, for those who preferred to seek medical care from private healthcare centres, the pandemic left them financially deficient, as medical aids either did not fully cover the COVID-19-related costs or did not cover the costs at all (Discovery 2020).

Reflecting on this demographic data, with a larger proportion of participants working in public healthcare settings, the findings may highlight the unique challenges faced in these institutions. These challenges include higher patient volumes, more limited resources, and greater exposure to the virus. With fewer participants, the private sector might have experienced a different set of challenges, such as better resources but potentially less frequent exposure to COVID-19 cases due to lower patient volumes during the pandemic.

Most participants attended to 1-10 COVID-19 patients per week, indicating varying levels of exposure to COVID-19 cases, which may have influenced the mental health and well-being experiences during the pandemic. Those who attended to more patients (11-20 patients) might have faced more intense stress. On the other hand, those with fewer patients may have had a less direct experience of the emotional and psychological toll on frontline radiology staff. The number of patients seen could also have affected perceptions of risk and the ability to adapt to changing work protocols.

Only three participants did not attend to any COVID-19 patients per week due to them occupying managerial positions such as Head of radiology unit (n=1) and radiography managers (n=2) at public tertiary institutions.

The researcher's overall impression of the demographic characteristics of the study sample, such as gender, professional status, workplace setting, and the number of COVID-19 patients attended to, provides valuable context for interpreting the findings. These characteristics offer insights into how different groups within the radiology department potentially experienced the COVID-19 pandemic. The emotional, psychological, and professional challenges they faced potentially varied based on their role, level of exposure, and available resources. The incorporation of the TMSC, HBM and AT in the subsequent sections will allow for an exploration of how these factors played a role.

6.3 FINDINGS

The themes and subthemes presented in chapter five are discussed in the following sections in relation to the existing literature and the study's theoretical framework (Modified TMSC incorporating HBM and AT). This discussion critically connects the study's findings with relevant theory, prior research, and their broader implications. It also highlights how the findings align with or diverge from existing knowledge, drawing attention to results that are unique to this study.

6.3.1 Frontline radiology staff's professional duties and roles with regard to COVID-19

Radiology staff carried out several duties, including both their usual and additional tasks. They continued with their regular clinical roles and responsibilities within the radiology department. However, the arrival of COVID-19 required them to take on extra duties. These additional tasks were required to incorporate the changes to protocols, IPC measures, and shift and patient bookings. The roles and responsibilities of the different professionals will be discussed in the following sections.

6.3.1.1 Roles of radiographers during the COVID-19 pandemic

The ability of chest x-rays and CT to assist with the management of COVID-19 patients (Kwee and Kwee 2020; Rousan *et al.* 2020) increased the radiology examinations conducted by radiographers under discussion. This was mostly applicable to bedside units (BSUs), high resolution computed tomography (HRCT) and computed tomography pulmonary angiograms (CTPAs). Chest x-rays were usually the initial medical imaging examination for COVID-19-related requests or to check the positioning for central venous pressure (CVP) and nasogastric tube (NGT) for COVID-19 patients who were in intensive care. Although the pH of the aspirated fluid is the first-line check for NGT position, Taylor and Manara (2021) indicated that a chest x-ray is highly recommended. This is especially important when attending to COVID-19 patients due to the

perceived risk of regurgitation of gastric fluid when the patient is either prone or turned to their side.

Xu *et al.* (2020) and Kwee and Kwee (2020) outlined that chest CT examinations worked well for differential diagnosis and detection of COVID-19-related complications. These complications included pulmonary embolism (PE), heart failure, and acute respiratory distress syndrome (ARDS), with HRCT recording a 73% accuracy. Furthermore, a meta-analysis conducted by Khatami *et al.* (2020) echoed the competitively high accuracy of CT in detecting COVID-19 and related complications with records of overall sensitivity (87%), specificity (46%), positive predictive value (69%) and negative predictive value of 89%. Nevertheless, x-rays and CT examinations were always coupled with Reverse Transcription Polymerase Chain Reaction (RT-PCR). This was due to the possibility of false-negative and false-positive outcomes, which relied on some dynamic variables (Kwee and Kwee 2020).

Considering how highly infectious COVID-19 is (Mohapatra *et al.* 2020), hospitals introduced protocols for imaging PUI and COVID-19 patients within secluded areas, such as isolation rooms in the accident and emergency (A&E) and designated COVID-19 wards. A radiology equipment market-growth report by Bhvita and Cooke (2022) corroborated these findings. They indicated that sales of mobile X-ray machines, in comparison to fixed-room radiography systems, spiked in the early phases of the pandemic.

Furthermore, these findings align with outcomes from other studies. These studies indicated that radiology departments in several geographical locations, including Africa, the USA, and the UK, experienced a rapid increase in the number of chest X-rays and chest CT examinations conducted during the COVID-19 pandemic (RANZCR 2020; Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022). Highlighted in their Ireland-based mixed-method study, Murphy *et al.* (2022) outlined that, in addition to an increase in the number of chest X-rays and CTPAs, they also observed a sharp rise in interventional radiology cases related to COVID-19

complications, such as blood clotting. Murphy *et al. (*2022) specified that peripheral angioplasty and embolisation cases were among those on the rise.

The roles of the radiographers involved continuous close contact and interaction with COVID-19 patients during the pandemic. As a result, radiographers were also closely involved in implementing IPC protocols. This was done to prevent the spread of the virus between themselves and the patients, as well as between patients. According to Lewis and Mulla (2020), in alignment with the national IPC protocols, radiographers were required to don and doff PPE when attending to COVID-19 patients. Additionally, they were also expected to sanitise and thoroughly clean the radiography equipment and accessories on a more regular basis than before, thus aligning with Heng *et al.*'s (2020) Singapore study. Participants indicated that sanitisation and cleaning routines were conducted early in the morning before attending to patients. These routines were also performed in-between patients and after attending to a PUI or COVID-19 patient who may have potentially contaminated the imaging rooms. For BSUs, radiographers were required to wipe down the mobile x-ray machine and cassettes. The cassettes were covered with more than one plastic casing prior to the examination to prevent cross-contamination.

Overall, these IPC measures and steps aligned with the Health Belief Model (HBM). The radiology staff perceived the severity of the risk that COVID-19 posed to their health as heightened. This perception influenced them to adhere to the recommended IPC protocols, which they believed had infection-prevention benefits. This is further confirmed by Heng *et al.* (2020). They reported the successful prevention of COVID-19 transmission among patients and radiology staff involved in 1,637 COVID-19-positive cases in Singapore, following strict adherence to IPC protocols.

As part of radiographers' scope of practice (HPCSA 2020), they were involved with the screening of x-ray request forms when patients presented to the department. This was to ensure that the examinations were justified as required by the South African Department of Health Directorate: Radiation Control

(SADHD: RC) (2016). This also corresponded with similar practices in other countries such as the UK, where radiographers have the role of a practitioner according to the Ionising Radiation (Medical Exposure) Regulations IR(ME)R (2017). These practices follow the radiation protection principles passed within Publication 103 of the International Commission on Radiological Protection (ICRP) (2007), which establishes that every x-ray exposure should be justified by weighing benefits versus the risks. In addition to checking for justification, radiographers were also checking the patients' COVID-19 screening information to ensure they were not either confirmed COVID-19 patients or PUI. This helped to avoid mixing COVID-19 patients with negative ones within the radiology departments, particularly in the waiting areas. This approach aligned with isolation strategies implemented in other radiology departments, such as those in Hubei province, China (Yu *et al.* 2020).

Reportedly, in some private radiology departments, radiographers were at times administering contrast media (CM) which is against the available HPCSA's scope of practice for diagnostic radiographers (HPCSA 2020). These findings correspond with Munro *et al.*'s (2012) study, which also reported similar practices among some South African-based radiographers. In South Africa, the administration of CM by diagnostic radiographers has been under a lot of scrutiny and discussion, with arguments that radiologists support incorporating the administration of CM into radiographers' scope of practice (Kekana, Swindon and Mathobisa 2015). As indicated by (Koch 2016), the restrictions do not align with other countries such as the UK, USA and Ireland where radiographers have been approved to be trained in-house and administer CM on an ongoing basis (Society of Radiographers 2020; Kolli *et al.* 2018; Toh, Reed and Robinson 2007; Cleary *et al.* 2017).

According to Bwanga, Kayembe and Sichone (2022), this has proven to help ease the burden of radiologist shortages, which would interfere with service delivery and patient throughput. The available scope of practice at the writing of this work is the HPCSA (2020) publication, which considers the responsibility of administering CM to lie with the radiologist due to the potential adverse

reactions with which patients could potentially present. However, the publication also indicated that the scope of practice is under review and awaiting approval by the Minister of Health. Therefore, it is unknown whether the administration of CM has been incorporated into the radiographers' scope.

Radiographers in public radiology departments were regularly involved with administrative duties such as taking telephone calls for BSU-related queries as well as capturing patients' details. This would normally be done by the clerical staff. However, the clerical staff are not available for night shifts as they are not compensated for such shifts. Also, liaising directly with a clinical staff member helped the referring departments communicate the message or discuss the radiology cases in detail for the benefit of the patient. On the other end, in smaller public radiology departments, this was a result of staff shortages, particularly in some clinics which were reportedly run and operated by a single radiographer. Besides telephonic communication with patient referrers, these findings differ from European healthcare systems where there are appointed radiology receptionists and assistants responsible for administrative duties and capturing patients' data (National Careers Service 2020). Additionally, a fully-integrated radiology Information System (RIS) and Picture archiving and communication system (PACS) eliminate the need for the radiographer to be involved in clerical duties as compared to the current findings. However, the findings would be comparable to other radiology departments without a fully functional PACS.

Radiographers in leadership roles such as chief radiographers and radiography managers were involved in the stocktaking and distribution of PPE among radiology staff. They were also responsible for communicating any changes to protocols and IPC policies to staff and ensuring the necessary training was provided. This was in alignment with the Department of Employment and Labour (DEL) (1993), which holds the employer responsible for informing the employee of any health and safety hazards in the workplace and provide necessary preventive guidance. Some radiography leaders were involved in decision-making relating to the IPC protocols together with the radiologists and

IPC team within their institutions. According to DEL (1993), each workplace with more than 20 employees should nominate a representative to sit at institutional IPC meetings and act as the middle person between the IPC committee and the staff. This ensures the channelling of communication in either direction in a coordinated manner DEL (1993).

In addition to this, radiographers in leadership positions were also involved in the day-to-day running of the radiology departments by managing staff's rotational shifts and ensuring every shift was covered. Increased absenteeism as a result of COVID-19-infected staff isolating and other staff absconding duties presented serious staff shortages. As a result, other radiography managers were involved in the medical imaging of patients to ensure continuity of service delivery. These acts echoed the recommendations of the Royal College of Radiologists (RCR) and Society and College of Radiographers (SCR) (2012), which emphasised the need for robust teamwork within radiology departments to ensure continued high-quality service to the patients and referrers.

Lazarus and Folkman's transactional model of stress and coping (1984) considers stress as a dynamic process. It emphasises the individual's appraisal of environmental stimuli as stressors and their perceived capacity to cope. The current findings suggest that changes to the professional duties of radiographers, such as increased workloads and additional responsibilities, likely functioned as stress stimuli. These changes, particularly when repetitive or burdensome, align with the concept of daily hassles, which can accumulate to create significant stress.

The expanded scope of radiographers' roles, particularly in public radiology departments, exemplifies how routine disruptions can act as stressors. The expansion of radiographers' primary role in diagnostic imaging to include clerical tasks such as patient data entry in public radiology departments and administration of contrast media in private radiology departments, potentially acted as stress stimuli, as they represented additional daily hassles. According

to the TMSC, repeated exposure to such minor stressors can cumulatively impact emotional well-being (Biggs, Brough and Drummond 2017).

6.3.1.2 Roles of radiologists during the COVID-19 pandemic

Radiologists performed ultrasound scans continuously within the radiology department and, when necessary, at patients' bedsides, depending on the patient's conditions. They also maintained their reporting responsibilities for various radiological examinations, including mammograms and the increasing number of CT scans. These trends align with findings from several geographical regions (RANZCR 2020; Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022).

During the national lockdown at level five, mammography examinations were suspended, resuming only as restrictions eased (NDoH 2020b; NICD 2020). This approach reflected infection prevention and control (IPC) measures observed in other countries, where elective and non-life-threatening procedures were similarly postponed (Naidich *et al.* 2020). For chest x-rays conducted in public radiology departments, only abnormal cases were referred to radiologists for reporting. This practice mirrors approaches in many countries, except the UK, where radiographers' expanded roles include reporting, thus ensuring timely issuance of radiological reports despite staff shortages (RCR and SCR 2012; Alahmari 2021).

Radiologists continued their involvement in patient screening to justify examinations, adhering to regulatory frameworks such as ICRP (2007), RCR & SCR (201), SADHD: RC (2016), and IR(ME)R (2017). These guidelines identify radiologists as practitioners responsible for justifying x-ray exposures. Radiologists consulted closely with referring clinicians to confirm the appropriateness of requested radiology examinations or to suggest alternative procedures when needed. This was mostly important for COVID-19 patients undergoing CT scans, as transporting these patients to radiology departments

required additional infection control measures, including extended cleaning and ventilation protocols.

These precautions aligned with practices in other radiology units (Salih *et al.* 2022; Niu *et al.* 2020). It is noteworthy, however, that according to SADHD: RC (2016), only radiologists can clinically justify high-dose examinations such as CT scans. This contrasts with the UK, where, according to RCR and SCR (2012) and IR(ME)R (2017), both radiologists and advanced radiography practitioners can serve as practitioners in justifying such examinations.

Additionally, radiologists played significant roles in formulating and implementing IPC protocols. The head of the radiology unit, along with a radiologist representative, typically served on the departmental IPC committee. Radiologists' IPC tasks often centred around ultrasound procedures, such as sanitising ultrasound probes and accessories and donning and doffing PPE when attending to PUIs or confirmed COVID-19 cases. These measures aligned with national IPC protocols (NDoH 2020b).

Radiographers and radiologists in both public and private radiology departments collaborated closely for the patient's benefit. This collaboration included radiographers seeking radiologists' input on suspicious x-rays and radiologists limiting CT scans to only those cases that were clinically justified, thereby reducing unnecessary staff exposure to the COVID-19 virus. Such teamwork aligns with clinical imaging recommendations emphasising collaboration within teams (RCR and SCR 2012).

From the perspective of the TMSC, radiologists' roles frequently involved direct interactions with patients and referring clinicians who may have had contact with COVID-19 patients or persons under investigation (PUIs). These interactions presented potential stressors, such as the risk of contracting the virus, aligning with the stimuli-response concept outlined in TMSC (Lazarus and Folkman 1984). The radiologists' efforts to minimise staff exposure by accepting only clinically justified CT scans reflect their acknowledgement of the

staff's susceptibility to the COVID-19 virus, in line with the Health Belief Model (Janz and Becker 1984; Rosenstock, Strecher and Becker 1988). This risk of virus transmission was identified as a potential stressor, consistent with the TMSC.

6.3.1.3 Roles of radiology nurses during the COVID-19 pandemic

Radiology nurses continued performing their routine duties, which included attending to patients before and after radiology examinations, particularly during CT scans involving contrast media administration. However, this practice differed when handling COVID-19 patients, as these patients were normally accompanied by nurses from the COVID-19 ward. This arrangement was an infection prevention and control (IPC) measure aimed at minimising radiology staff's exposure to the virus. Radiology nurses only assisted with imaging COVID-19 patients or persons under investigation (PUI) when the patient arrived unaccompanied. In such cases, the radiology nurse would check the IV line for contrast media administration suitability and address any other nursing needs. These roles are consistent with practices in other countries, such as the UK and USA (Leeds Teaching Hospitals 2023; Hamlin 2022).

From the perspective of the TMSC, radiology nurses remained largely within their established scope of practice. As a result, they may have experienced fewer stressors compared to radiographers, whose duties were significantly altered by the pandemic. However, further exploration of the radiology nurses' experiences could provide insight into their perceptions of COVID-19 and its consequences. Reduced direct contact with COVID-19 patients may have lessened the emotional burden associated with fears of contracting the virus, aligning with the HBM's concept of perceived susceptibility (Janz and Becker 1984; Rosenstock, Strecher and Becker 1988). The reduced contact time could have contributed to a lower emotional toll compared to other radiology staff who were more frequently exposed to COVID-19 patients.

6.3.1.4 Researcher's reflection on the theme 'Frontline radiology staff's professional duties and roles with regards to COVID-19.'

The findings of this study contribute to the existing body of knowledge by corroborating key changes and adaptations in radiology and radiography practices during the COVID-19 pandemic. The increase in radiographers' workload, and increased use of x-rays, particularly as BSUs and CT align with existing literature. Another important contribution of this study is the insight into the expanded roles of radiographers during the pandemic. This includes additional responsibilities such as patient screening, administrative tasks, and involvement in infection prevention and control (IPC) protocols. The study provided an insight into the challenges faced by radiographers, particularly in under-resourced settings where they were required to take on roles typically outside their scope of practice, such as administering contrast media.

The study's findings regarding the administrative duties of radiographers to bridge gaps in staffing during the pandemic add to the ongoing discourse about workforce shortages and the adaptability of healthcare staff during crises. The comparison with practices in countries such as the UK, where radiographers have expanded roles, further contextualises these findings, providing a global view of the evolving scope of practice within the profession. The findings also reflect the increasing need for robust teamwork and the implementation of IPC protocols, which ensured the safety of radiology staff while delivering critical care, aligning with practices observed globally in response to COVID-19.

Furthermore, the theme offers an invaluable contribution by linking the theoretical framework of the TMSC to the experiences of eThekwini radiology staff during the pandemic. The TMSC helped outline how daily stressors, such as increased workloads and expanded roles, accumulated over time, and potentially increased emotional strain among radiographers, as evidenced by the significant shifts in their duties and responsibilities.

6.3.2 Perceived personal and work-related challenges faced by frontline radiology staff during the COVID-19 era

Challenges faced by radiology frontline healthcare workers at personal as well as work-related levels fell into the following categories, which are expanded in subsequent sections.

6.3.2.1 Unpreparedness and perceived increased risk of infection

A significant number of frontline radiology staff did not feel safe working within their departments during the COVID-19 pandemic. Participants felt at increased risk of contracting the virus at work, mainly due to shortages of resources that could prevent its spread. This included PPE, which was particularly challenging in public radiology departments. Many participants reported that very often there was either no PPE available, incomplete PPE sets issued or a lack of training on how to properly don and doff PPE during the early days of the pandemic.

This situation aligns with the TMSC, which highlights the dynamic interaction between individuals and their environment. In this context, the radiology staff's workplaces were perceived as unsafe, contributing to potential stress. The increased risk of contracting COVID-19 was identified as a significant environmental stressor, a key element of the TMSC (Lazarus and Folkman 1984).

As part of their primary appraisal, the perceived inadequacy of protective measures heightened their sense of vulnerability, increasing stress levels. The lack of PPE and insufficient training undermined the staff's confidence in their ability to mitigate infection risks. This aligns with the TMSC's concept of secondary appraisal, where individuals assess their available resources and skills to manage the stressor (Lazarus and Folkman 1984). For many radiology staff, the absence of adequate PPE or clear guidance likely induced a sense of helplessness, exacerbating their stress and influencing their coping strategies. The persistent inadequacy of resources created a continuous environmental

stressor, requiring staff to repeatedly reappraise and adapt their responses while managing their daily responsibilities.

These findings also correlate with the Health Belief Model (HBM), which indicates that perceived susceptibility can influence health behaviours (RHIH 2018). In this case, participants within public radiology departments perceived COVID-19 as a threat to their well-being. Hence, they aimed to wear full PPE whenever attending to COVID-19 patients. Participants perceived the unavailability or shortage of PPE as a barrier to practising preventative health behaviours. Thereby contributing to their perceived susceptibility to contracting the virus. In alignment with the AT, the unavailability of PPE, which attributed to the perceived increased risk of infection, acted as an external attribution (situational attribution) since it was beyond the participant's personal control (Mcleod 2023; LaMorte 2022).

Training on donning and doffing PPE was eventually provided by the institutions thus adhering to the employer's responsibility of providing health and safety training as stipulated by DEL (1993). Despite the training, some participants continued to feel nervous, doubting whether they had worn PPE appropriately when attending to COVID-19 patients. The unavailability of PPE was not unique to these participants as several other countries experienced similar shortages indicating that this was a global crisis (Zanardo *et al.* 2020; Gitau 2020; Akudjedu *et al*. 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022).

These shortages could be attributed to the unpreparedness of health departments and nations for this health crisis (Yu *et al.* 2020; Murphy *et al.* 2022). Considering that this was a unique virus, preventive wear had not always been available. Therefore, the time taken to research the best gear to protect healthcare staff from getting infected by the virus, coupled with the increased number of COVID-19 patients worldwide, resulted in an increased demand for PPE. This demand exceeded what was available on the market (Worldometer 2020; Worldometer 2023).

Participants working in private radiology departments indicated that PPE was never a challenge, implying that it was readily available. This could be attributed to the number of employees within the private practice, which is significantly low. These numbers enable proper management and distribution of PPE, in comparison to the public healthcare sector, where there are a greater number of employees within the departments (Wishnia *et al.* 2019; Ahmat *et al.* 2022). Considering that most patients were seeking assistance from public healthcare institutions (Wishnia *et al.* 2019), the number of COVID-19 patients attending private radiology departments was less compared to those attending public radiology departments. As a result, the demand for PPE was probably not as high as that experienced within the public healthcare system. Also, considering that private practices seek to make a profit as they provide a service to the community (KZN Transport 2023), one of the participants (radiography manager) indicated that there was a need to look after the staff to ensure continued service delivery.

Radiographers perceived themselves as frontline healthcare workers because they were closely involved in managing PUI and COVID-19 patients. However, they felt that other staff often failed to recognise this, particularly in situations such as the allocation of PPE and other matters concerning frontline healthcare workers during the pandemic. Participants (radiographers) felt their profession was not well recognised, and that most staff outside the radiology department were unaware of their duties, leading to the lack of recognition. According to Chevalier *et al.* (2022), this potentially leads to emotional exhaustion and demotivation of staff.

The perceived non-recognition of radiographers has been under discussion for over a decade. Research both nationally and globally, has shown that radiographers, including reporting radiographers in the UK, feel their efforts, hard work, and professionalism are taken for granted within the healthcare sector (Nightingale and Hogg 2003; Gqweta 2012; Britton, Lawrence and Pieterse 2017; Chevalier *et al.* 2022). Therefore, in accordance with the Attribution Theory (AT), participants potentially viewed this as an external

attribution for the unfair distribution or non-allocation of adequate PPE to the radiographers (Palmier and Peterson 2009). Additionally, in alignment with HBM, this was perceived as a barrier to using PPE, which was meant to protect participants from the virus while attending to COVID-19 patients (Carpenter 2010).

In line with TMSC, through primary appraisal, in addition to the potentially significant stressor (shortage of PPE), radiographers' role as frontline healthcare workers exposed them to frequent contact with COVID-19 patients and PUIs, heightening their risk of infection (Lazarus and Folkman 1984). The perceived inadequacy of PPE distribution added to this appraisal, leading radiographers to feel unprotected and undervalued. For private radiology staff, the availability of PPE likely resulted in a more positive secondary appraisal, as they felt supported and equipped to manage the risks (Lazarus and Folkman 1984). In contrast, public radiology staff likely perceived inadequate PPE as a barrier to effective coping. The lack of recognition for their contributions further undermined their efforts and contributions.

In keeping with AT and HBM (Palmier and Peterson 2009; Janz and Becker 1984; Rosenstock, Strecher and Becker 1988), some participants working within public radiology departments perceived the shortages of PPE to be externally attributed. They linked this either to non-empathetic management (departmental and institutional) or to the perceived complex public healthcare resource acquisition policies. As a result, they felt that staff were intentionally put at risk of contracting the virus while attending to COVID-19 patients.

Additionally, management was considered non-empathetic to the staff and pandemic-related challenges due to the non-recognition of co-morbidities and staff's health and recovery. Research has indicated that individuals with co-morbidities such as asthma are at an increased risk of suffering severe COVID-19 symptoms (CDC 2023b). However, in other private radiology departments, vulnerable staff were identified and exempted from some duties as a way of lowering their exposure to the virus. This was a bit challenging in public

healthcare institutions as participants perceived that due to increased demand for medical imaging, the focus was on service delivery regardless of the employee's health and associated risks.

These findings are not unique to the study population. Bhui *et al.* (2016) reported management practices as one of the causes of occupational stress among employees in both private and public workplaces within the UK. However, most complaints were among participants in public service. Bhui *et al.* (2016) also added that the specific concerns raised by participants from 12 diverse working environments, including healthcare, comprised unrealistic demands, pressure, conflicting roles, effort-reward imbalance, lack of warmth, lack of support and appreciation. Other concerns included unfair treatment, no participation in decision-making, lack of transparency, and poor communication. The current study's findings echo similar concerns within public radiology departments. Occupational stress has been reported to impact employee performance, staff retention, and contribute towards staff absenteeism. Hence, any contributors to occupational stress should be addressed within institutions. Gam (2015) and Fishman *et al.* (2018) indicated links between emotional or psychological distress with an increase in radiological diagnosis errors, poor patient care, and increased litigation.

These findings align with the TMSC as it highlights how environmental factors, such as management practices and institutional policies, potentially acted as stress stimuli that radiology staff had to appraise and respond to. The shortage of PPE in public radiology departments represents an environmental demand that staff had to potentially appraise as either threatening or manageable. Staff perceiving this as a result of non-empathetic management or public healthcare policies indicates a primary appraisal of the situation as harmful or challenging, aligning with TMSC (Lazarus and Folkman 1984). Similarly, the perceived disregard for co-morbidities and health recovery reflects a direct appraisal of a stressor where staff weigh the risks to their health against their professional obligations. The persistent lack of support and empathy from management

aligns with secondary appraisal, where individuals evaluate the adequacy of available resources to cope with the stressor (Lazarus and Folkman 1984).

The public radiology staff's perception that their needs were ignored highlights institutional-related coping barriers. This indicates broader issues, such as differences between public and private radiology departments and resource allocation policies. Although recognised as external stressors, these systemic challenges may require intervention beyond TMSC's individual appraisal and coping mechanism concepts (Lazarus and Folkman 1984).

On the positive side, some radiography managers assisted in covering shifts during staff shortages by doing the clinical work and attending to patients. This was a good motivation for the staff who were putting their lives at risk on a daily basis. This echoed the motivation and teamwork spirit encouraged within clinical imaging by RCR and SCR (2012).

In addition to the unavailability of PPE or inadequate PPE, participants (radiologists and radiographers) working in public radiology departments felt their facilities were not structurally ready to handle the crisis. Challenges aligning with this included a shortage of space within reporting rooms, duty rooms and waiting areas to allow for social distancing. Additionally, patients could not be adequately segregated based on their COVID-19 status, as there were no isolating facilities within the departments. This therefore, presented as a major perceived barrier to adhering to IPC guidelines of social distancing. It also outlined the perceived susceptibility of not adhering to social distancing, as this was a perceived benefit which could potentially minimise the spread of the virus, aligning with the HBM (Carpenter 2010; LaMorte 2022). This was, however, not unique to only these radiology departments. Some departments within Hubei province, China, experienced similar challenges. These challenges were due to departmental layouts that were not accommodative of isolation strategies (Yu *et al.* 2020).

In addition to staff shortages and the discomfort of wearing PPE for longer periods, participants perceived the newly introduced IPC guidelines as time-consuming. This increased examination time, created a backlog, and added to the cumulative workload due to the increased patient numbers. However, participants indicated that this was dependant on the national lockdown level and status of alcohol sale restrictions (NDoH 2020b). Similar findings were reported by Salih *et al.* (2022) and Murphy *et al.* (2022) as radiology staff in other countries, such as Ireland, complained of fatigue resulting from increased workload and sanitation processes.

The shortages of PPE and inadequacies in physical infrastructure were appraised by participants as stress-inducing barriers. According to TMSC, individuals evaluate the severity of stressors in their environment (Lazarus and Folkman 1984). In this case, participants identified risks to their health and safety (e.g., exposure to COVID-19 and lack of isolation facilities). Thereby also aligning with HBM (Janz and Becker 1984). The lack of social distancing infrastructure heightened the perception of susceptibility to infection, acting as a potential stressor. This aligns with TMSC's and AT's emphasis on stressors arising from external conditions (Lazarus and Folkman 1984; Palmier and Peterson 2009).

Participants evaluated the new IPC guidelines and extended PPE usage as additional demands on their time and energy. The guidelines, though intended to mitigate risks, were perceived as burdensome and time-consuming, thereby increasing workload and cumulative stress. While participants accepted these practices as necessary (indicating problem-focused coping), their fatigue and frustration reflect the emotional impact of these changes (Lazarus and Folkman 1984). The challenges outlined, such as inadequate physical layouts, limited isolation facilities, and insufficient PPE, emphasise organisational and systemic stressors. These factors are beyond the radiology staff's control, thereby potentially limiting the effectiveness of coping through personal strategies.

The time-consuming nature of IPC protocols indicated an operational-related stressor (Lazarus and Folkman 1984). The perceived impact of national lockdown levels and alcohol sale restrictions on patient numbers and workload highlights how macro-level policies influence stress dynamics. These factors, though external to the immediate environment of radiology departments, directly shaped the radiology staff's workload and potential stress levels. AT recognises these as external attributors (Palmier and Peterson 2009).

Although not indicated in the current data, Natembeya *et al.* (2024) reported a shortage of essential clinical radiology consumables, such as contrast media, due to supply chain disruptions caused by COVID-19-related travel restrictions.

6.3.2.2 Adaptation to changes in systems, protocols and structures in response to the pandemic

The arrival of the COVID-19 pandemic brought about significant changes within radiology departments in the eThekwini district of KZN. These changes ranged from the introduction of new IPC protocols to ensure the prevention of the spread of the virus within the radiology departments to the booking of patients as well as duties and shift rotation.

New IPC protocols included the use of PPE, intense cleaning protocols as well as social distancing within the department. These changes were in accordance with the regulations issued by the NDoH (2020b) and WHO (2020b). This also aligned with protocols implemented worldwide as evidenced in studies conducted in countries such as Ireland, Singapore and China (Heng *et al.* 2020; Salih *et al.* 2022; Murphy *et al.* 2022). However, the rapid rate of updating the protocols made it difficult for the participants to keep pace and brought a lot of frustration. The rapid changes in protocols and regular updates were also experienced in other South African provinces and international radiology departments due to the unknown nature of the virus. Hence, new information resulted in changes to protocols on a much more regular basis (Lewis and Mulla 2020; Gitau 2020; Heng *et al.* 2020; Salih *et al.* 2022; Murphy *et al.* 2022).

With regard to the use of PPE, participants complained of the discomfort associated with wearing PPE over longer periods of time. Additionally, participants were initially not certain about how to don and doff the PPE properly, resulting in difficulties in transitioning into the new way of work. However, healthcare institutions eventually provided training. This brought about relief and some confidence in the participants as they conducted their duties during the pandemic. These findings converge with experiences of other radiology staff globally as indicated by Swaminathan, Mukundadura and Prasad (2022) and Murphy (*et al.* 2022).

Due to the nature of COVID-19, which is easily spread through contact via droplets (CDC 2023a), new cleaning protocols were introduced within radiology departments. However, participants considered these protocols to be intense as they were required to be conducted frequently and rigorously to ensure the elimination of the virus to prevent infection of both staff and patients. For example, the radiology staff were required to clean the radiology equipment and accessories in between patients, as well as early in the morning or following the use of the equipment to examine either PUIs or COVID-19 patients. Considering the intensity of the recommended cleaning protocols, participants found this tiring, repetitive and increased overall radiology examination times. These findings echo the experiences of fellow radiology staff in Ireland, the UK, USA, Australia and Ghana (Akudjedu *et al*. 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021 and Murphy *et al.* 2022).

According to the findings of the current study, in addition to rigorous cleaning, some public radiology departments required the radiology department or the particular medical imaging room that had been used for a COVID-19 patient to be evacuated. Initially, this was done for at least four hours and later reduced to two hours. Although globally other radiology departments were also allowing downtime following the imaging of a COVID-19 patient, the typical downtime was 30 minutes to one hour to accommodate room decontamination and passive air exchange (Mossa-Basha *et al.* 2020). The stretched downtime indicated by the findings of the current study created a backlog of patients due

to the disruption of service. Consequently, the workload for the staff coming for the next shift was significantly increased.

Participants also expressed concerns with regard to inconsistencies in implementing the downtime protocol of certain radiology departments. The concerned participants (radiographers) indicated that this rule was mostly applicable to CT rooms where radiologists inject contrast media and not x-rays rooms, as they do not access them. This created tension within the concerned departments. This was because some professionals, particularly the radiographers, felt the protocols were favouring radiologists and not taking the radiographers' safety into consideration. These findings echo the results of Chevalier *et al.*'s (2022) French-based cross-sectional study. Chevalier *et al.* (2022) went on to explain that, in addition to non-recognition in the workplace, unfairness can contribute to poor job satisfaction and retention among workers.

Although the social distancing protocol aimed to minimise the risk of infection, participants felt this regulation resulted in detrimental disruption of social relations within the department. This included disruption of peer-to-peer interactions due to the limit on the number of people that were allowed in a closed space (NDoH 2020b). Departmental social events or meal sharing were banned, resulting in no social interaction with colleagues. Considering the nature of radiology examinations, where radiology staff need to be in close contact with patients, it was not feasible to ensure social distancing while attending to patients. Resultantly, the radiology staff were continuously in close contact with PUIs and COVID-19 patients as they conducted their duties.

Duties and shift rotations were also significantly impacted, although for different reasons. In public radiology departments, the increased workload coupled with the significant staff shortages due to participants regularly taking sick leave resulted in more shifts and longer working hours for those who were on duty. This was to ensure continued service delivery. On the other hand, for those in private practice, non-renewal of other staff's work contracts and reduced work hours to accommodate staff cuts resulted in a reduced number of staff available

to cover shifts. Hence, those who were left within the department had to work longer shifts and at times miss lunch or supper break to cope with the workload. These findings are not unique to radiology departments within the eThekwini district of KZN. A Gauteng-based study and global studies recorded similar challenges of staff shortages and increased working hours to meet the increased medical imaging demands during the pandemic (Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022).

Pertaining to the booking of patients, initially, there was a reduction in the number of patients that were being booked in alignment with the regulations of the lockdown level five. The regulations called for the cancellation of all booked medical procedures and examinations, such as mammography examinations (NDoH 2020b). Although this reduced the workload for the staff, participants who worked closely with mammography patients were negatively affected by this, as they knew how much the patients needed this as part of their healthcare management. This emphasises the long-standing significant role of mammography in breast cancer diagnosis and management (Ekeh, Alleyne and Duncan 2000).

Mammography restrictions were eventually lifted as the lockdown levels reduced (NDoH 2020b). However, the resultant backlog brought about a heavy workload for the radiology staff. These findings align with Mc Fadden *et al.*'s (2022) Northern Ireland-based exploratory study, which reported disruptions in radiology and radiotherapy service delivery coupled with heavy workloads during the COVID-19 pandemic. Furthermore, Mc Fadden *et al.* (2022) indicated that oncology patients were hugely affected due to delays in treatment following the cancellation of surgeries.

The CT booking system was continuously updated to accommodate COVID-19 patients as CT provided guidance on the management of COVID-19-related complications. This aligned with other radiology departments (Mossa-Basha *et al.* 2020). All other patients were allocated morning to midday appointments, while the afternoon CT slots were reserved for PUIs and COVID-19 patients.

Considering the protocol of closing CT departments following the imaging of a PUI or COVID-19 patient, this meant that any emergency CT cases could not be carried out during the two or four-hour period. As a result, the management of patients in critical conditions who rely on CT for guidance was impacted.

Authors argue that the heightened discrepancies in radiology protocols were attributed to the lack of radiology-focused COVID-19 guidelines within sub-Saharan Africa as well as worldwide (Mutala, Onyambu and Aywak 2020; McFadden *et al.* 2022). Additionally, the current study population and radiology staff in most departments complain that these protocols were formulated at the institutional level without any radiology representation (McFadden *et al.* 2022). This echoes the perceived non-recognition of radiology professionals as frontline workers.

Participants appraised various stressors, such as the discomfort of prolonged PPE use, intense cleaning protocols, disruptions in social interactions, and inconsistencies in downtime implementation. Thereby reflecting the process of primary appraisal in TMSC (Lazarus and Folkman 1984). The concerns about staff shortages, increased workloads, and the exclusion of radiology staff in IPC protocol development also align with the recognition of external stressors in TMSC and external attribution in AT (Lazarus and Folkman 1984; Palmier and Peterson 2009).

The provision of training for PPE use and the gradual adaptation to IPC protocols reflect secondary appraisal, where participants assessed available coping resources. While initial difficulties were perceived as overwhelming, training brought confidence and some relief, exemplifying the dynamic process of reappraisal in TMSC (Lazarus and Folkman 1984). The disruption of social relationships due to distancing measures and cancelled departmental events caused feelings of isolation among participants. These emotional responses align with TMSC, as they influence how individuals cope with stress (Lazarus and Folkman 1984). Reduced peer-to-peer interaction and departmental tensions from perceived unfair protocols further reflect emotional stressors.

The constant changes to protocols presented a unique challenge, where stressors were not static but dynamically evolving. This required repeated reappraisal without consistent resolution (Lazarus and Folkman 1984). Institutional protocols, such as long downtimes for CT rooms and inconsistent application of safety measures between CT and x-ray rooms, created additional stressors rather than resolving existing ones. These challenges highlight the organisational gaps in pandemic response, a factor AT identifies as external attribution (Palmier and Peterson 2009).

6.3.2.2 Information about COVID-19

The unavailability of adequate information about the nature of COVID-19, its transmission, and the best preventative methods instilled fear within participants. There was a lot of confusion regarding the best IPC protocols. Since the scarcity of information was also experienced at institutional, national, and international levels, IPC protocols were regularly updated. This led to frustration within departments and among participants. Northern Ireland-based radiology and radiotherapy departments faced similar challenges and expressed their frustration in McFadden *et al.*'s (2022) study. Globally, research indicated that a lack of COVID-19-related training correlated with heightened fear among radiology staff (Elshami *et al.* 2021).

Poor interdepartmental information sharing of patients' COVID-19 status resulted in a lack of proper preparation for examinations. This particularly affected gearing up PPE, preparing the radiology room, and isolating the patient appropriately to protect other radiology patients in the department. Radiographers working in public healthcare institutions complained that referring doctors repeatedly did not provide the patient's COVID-19 information on the x-ray request forms. As a result, the department would often only realise after conducting an examination that the patient was COVID-19 positive. This was either through their own follow-ups or when the referring department contacted them as part of contact tracing. Inadequate completion of radiology request forms has been a concern for a prolonged period. Studies in several

parts of the world, such as Ghana, Nigeria, Sudan, and the UK, have reported a scarcity of adequately filled forms, resulting in their poor usefulness in some instances (Akinola *et al.* 2009; Yousef *et al.* 2011; Abbas, Omer and Hamad 2016; Lowe and Health 2019; Garba *et al.* 2021; Jimah 2021).

The Royal College of Radiologists (RCR) (2021) reiterated the importance of providing an adequate clinical background of the patient as part of the responsibilities of referrers, according to ICRP (2007) and IR(ME)R 2017. Locally, this also aligns with the regulations stipulated by SADHD: RC (2016). Participants claim that referring departments cited delays in obtaining patients' COVID-19 results as the reason for omitting COVID-19 statuses on radiology request forms. RT-PCR results were taking approximately three days to be released in public healthcare institutions.

In a Northern Ireland-based study, 70% of radiology staff reported having contact with asymptomatic patients who were later confirmed as COVID-19 positive (McFadden *et al*. 2022). Therefore, the challenges of limited testing resources and a lack of awareness placed other healthcare workers at risk of contracting the virus. However, this was not the only effect. Staff shortages and service delivery were impacted by prolonged staff sick leave, as employees had to quarantine for several days while awaiting their COVID-19 results. Anecdotal evidence suggests that, due to frustration and fear of working during the pandemic, some staff did not mind regularly going for COVID-19 testing. This was seen as a way to stay away from work during the quarantine period.

Fear and confusion, caused by a lack of information about COVID-19 and its transmission, are central to the primary appraisal in TMSC (Lazarus and Folkman 1984). Radiology staff perceived these information gaps as a significant stressor, evaluating the situation as harmful and uncertain. Frustration due to poor communication, such as missing COVID-19 status on referral forms, can be considered an emotional response. Radiology staff expressed frustration over systemic issues that hindered their ability to protect themselves from COVID-19 effectively. The fear of contracting the virus due to

inadequate IPC protocols also reflects primary appraisal, where individuals assess threats based on available information and perceived risks (Lazarus and Folkman 1984). The regular updates to IPC protocols, which often led to frustration, also fall under the primary appraisal stage. As these protocols were continually revised, participants appraised them as confusing and overwhelming, especially in the absence of clear, consistent guidance.

Applying TMSC to the data - the inadequate provision of PPE, room preparation and patient isolation were seen as gaps in the system, which heightened stress as radiology staff lacked the resources to adequately manage the situations they faced. Despite the frustration, some coping strategies could be seen in the individual responses to these stressors. For instance, radiographers adapted to the challenges by carrying out follow-ups or initiating contact tracing themselves. This illustrated an attempt to reorganise resources to mitigate the stressor, which was the fear of exposure to COVID-19.

The heightened fear and anxiety experienced by the radiology staff, particularly in the face of unclear protocols and risk of exposure, are key emotional responses to stressors, in line with TMSC (Briggs and Drummond 2017). Participants also experienced emotional distress from not being adequately prepared for COVID-19-positive patients, further reflecting the psychological and emotional strain TMSC identifies in response to stressors (Lazarus and Folkman 1984).

In line with AT, the lack of interdepartmental information sharing is an example of organisational stressors (external attribution) contributing to confusion and fear (Palmier and Peterson 2009). This also aligns with the TMSC (Lazarus and Folkman 1984), which highlights that stress is not only an individual experience but can be exacerbated by interpersonal and organisational dynamics. In this case, poor communication and collaboration between referring departments and radiology staff acted as external stressors, reducing the ability of individuals to manage their stressors effectively. These organisational problems likely

created stressors that radiology staff felt powerless to change, thereby challenging individual control over stress and coping.

6.3.2.3 Physical health

The impact of COVID-19 on the participants' physical health included contracting the virus, which brought long-lasting effects such as fatigue. This altered their way of life and overall health. This aligns with systematic reviews and national healthcare systems, which have identified that the effects of COVID-19 can persist beyond 12 weeks of recovery in some individuals (Leung *et al.* 2020; Higgins *et al*. 2020; Birman 2023; National Health Service 2023).

Referred to as 'long COVID' by National Health Service (NHS) (2023), the prolonged effects of COVID-19 have been documented to target multiple body systems. Common symptoms include fatigue, cardiovascular-related issues, muscle aches, and insomnia (Birman 2023; NHS 2023). Although the long-term implications of COVID-19 are yet to be fully documented, participants in the current study expressed concerns about 'not being the same again' after contracting the virus. This is worrying, as survivors of previous coronaviruses have continued to experience long-term effects (Higgins *et al.* 2020).

Severe acute respiratory syndrome coronavirus 1 (SARS-CoV-1) survivors experienced physical fatigue, osteoporosis, and necrosis of the femoral head 18 years later (Li *et al.* 2023). Similarly, a majority of survivors of the Middle East respiratory syndrome coronavirus (MERS-CoV), particularly healthcare workers, recorded high levels of psychiatric disorders such as anxiety, depression, and post-traumatic stress disorder (PTSD) (O'Sullivan 2021). Furthermore, participants felt demotivated to continue as healthcare practitioners due to the impact of the virus on their physical well-being and families. Some reported that family members contracted COVID-19 and blamed them for it. Although the recommended isolation period was 10 days at the time of data collection (NDoH 2020c), participants did not look forward to returning

to work after isolation. They felt they had not physically recovered, especially considering the physical demands of their jobs.

In addition to these concerns, participants complained about the impact of increased workload, including more patients and longer shifts, on their health. Many reported experiencing back pain due to carrying x-ray cassettes to and from COVID-19 wards at an increased frequency. Some radiology departments, particularly in public healthcare institutions, indicated that they were still using cassette-based x-ray imaging – Computed Radiography (CR). This was likely due to the significant financial costs of transitioning to a fully digital radiology department (Thomas 2018). As a result, the change was not as swift as in developed countries.

According to Sonoda *et al.* (1983), developed nations adopted digital-based radiography systems introduced by Fujifilm Medical Systems in the mid-1980s. However, the current study population's imaging technology is comparable to that of other African countries and less developed countries in the Middle East. Many of these regions continue to use CR, as it is compatible with x-ray machines from previous film-screen imaging systems, thereby reducing costs (Thomas 2018; Bhvita and Cooke 2022).

Participants with additional circumstances, such as underlying medical conditions and natural situations such as pregnancy, felt working in close contact with COVID-19 patients placed them at a higher risk for heightened complications. CDC (2023b) indicate an evidence-based correlation between pregnancy, certain underlying medical conditions (e.g. asthma) and the severity of COVID-19 symptoms in patients. This tied in with participants' fears.

The physical health impact of COVID-19, specifically fatigue and long-lasting health effects, aligns with primary appraisal in TMSC (Lazarus and Folkman 1984) and HBM (perceived susceptibility) (Janz and Becker 1984), where participants perceive these health effects as threats to their well-being. The chronic symptoms (fatigue) experienced by participants after contracting the

virus align with TMSC's view that stress arises when individuals evaluate situations as harmful to their health and well-being (Lazarus and Folkman 1984). Participants who contracted COVID-19 and experienced long-term effects such as 'long COVID' may see their health as compromised, impacting their ability to return to their normal duties, particularly in a physically demanding job. This resonates with the primary appraisal of stress, as individuals perceive these lingering symptoms as ongoing threats to their functioning (Lazarus and Folkman 1984).

The fatigue and physical challenges following illness can be seen as a stressor that individuals need to manage. Secondary appraisal would involve participants assessing their resources to cope with this stressor (Lazarus and Folkman 1984). For example, the participants felt demotivated to return to work, suggesting a lack of coping resources (physical health and stamina) that might help them deal with the stress of resuming work. This is in line with TMSC, where individuals assess whether they have enough resources (both physical and emotional) to cope with the demands placed on them (Lazarus and Folkman 1984).

The increased workload (due to staff shortages and the rising number of patients) and the physical demands of the job (e.g., carrying heavy x-ray cassettes) also align with TMSC's concept of secondary stressors and AT's external attribution, particularly those coming from the work environment (Lazarus and Folkman 1984; Palmier and Peterson 2009). Participants felt physically overwhelmed by the demands of their roles, especially in the context of ongoing health issues (e.g., back pain) and the absence of updated or modern equipment. These work-related stressors are processed as secondary stressors that participants had to cope with by evaluating whether they can meet the demands or whether it exceed their capacity.

6.3.2.4 Financial hardships

The radiology department was not immune to the financial burden brought about by the pandemic worldwide. Participants working in private radiology practices suffered significant salary reductions of up to 50%, as well as non-renewal of contracts, due to a massive decrease in patient statistics during the lockdown. This was particularly evident during lockdown level five, which required the cancellation of medical examinations (NDoH 2020b), as well as patients' preference for public healthcare facilities for COVID-19 diagnosis and management instead of private practices (Wishnia *et al.* 2019). This was due to the associated costs and bills in private healthcare (Modisakeng *et al.* 2020) and concerns about compromised equipment from a lack of funding, as this was a new infection.

Participants working in private practice who were affected by salary cuts claimed management did not inform them beforehand, despite their frequent enquiries about whether the reduction in patient numbers would impact their jobs and income. Allegedly, management reassured them that no salary cuts or job losses would occur, only for the concerned radiology staff to discover on payday that they had not been paid in full. Some participants had to live on savings and cancel holiday trips to cope with financial bills. Given that the dominant age range of participants is 18-49 years, most are likely breadwinners (OECD 2020). Thus, the unplanned financial burden had ripple effects.

These findings align with the salary cuts experienced by some Gauteng, Irish and Lebanese radiographers in private practice (Lewis and Mulla 2020; Itani *et al.* 2021; Murphy *et al.* 2022), as well as USA-based private radiology practices (Cavallo 2020). However, the salary cuts in Lebanon cannot be attributed solely to COVID-19, as Itani *et al.* (2021) highlighted that, regardless of the pandemic, the country was already suffering from high inflation rates and a severe economic crisis. For the current study, to avoid cumulative outstanding salary payments, private radiology employers chose not to renew contracts and reduced some staff members' working hours to match the salaries being paid.

Additionally, staff in private radiology departments complained that they had to cover their own COVID-19-related medical costs, such as testing. This was regardless of any work-related history of exposure, aligning with the experiences of Lebanese-based private radiographers (Itani *et al.* 2021). Participants in public healthcare institutions did not experience salary cuts. However, some complained about unexpected extra expenses related to hospitalisation for COVID-19 management in private hospitals, as medical aids did not cover most COVID-19-related expenses (Discovery 2020).

With reference to TMSC, salary reductions, contract non-renewals, and financial instability were clear stressors that participants experienced. In line with TMSC (Lazarus and Folkman 1984), the primary appraisal involved participants recognising these situations as threats to their financial stability and well-being. For example, private radiology staff who faced sudden salary cuts appraised these events as harmful and directly affecting their ability to meet financial obligations, particularly since many were likely breadwinners. The stress caused by unplanned financial burdens (e.g., covering medical expenses) is also in line with primary appraisal, as participants viewed these circumstances as uncontrollable and distressing. Participants' responses, such as relying on savings or adjusting their financial plans (e.g., cancelling holiday trips), reflect the secondary appraisal process, where individuals evaluate their available resources to manage the stressor. The absence of support from management (e.g., lack of communication regarding salary reductions) diminished participants' perceived resources, thereby exacerbating the stress associated with financial insecurity.

The failure of management to inform participants of salary cuts reflects a workplace-related stressor, which aligns with TMSC's acknowledgement of organisational and interpersonal factors influencing stress (Lazarus and Folkman 1984). This is also in keeping with the AT, which recognises external attribution (organisational factors influencing stress) (Palmier and Peterson 2009). The financial impact of the pandemic on private radiology practices (e.g., decreased patient numbers and salary) is primarily a systemic issue rather than

an individual one. The violation of trust and uncertainty about income contributed to participants' stress, as they were left feeling unprepared and unsupported.

6.3.2.5 Social shielding responsibility for family members

Working in close contact with COVID-19 patients almost daily and returning to family members with the possibility of having contracted the virus weighed heavily on the radiology staff under discussion. Having family members who are either advanced in age or have existing underlying medical conditions exacerbated this challenge. This was because the staff felt they were placing their loved ones at a higher risk of contracting the virus and experiencing severe complications if infected. These fears were validated, as CDC (2023b) highlighted that existing medical conditions such as asthma and hematologic malignancies place individuals at a higher risk of at least one severe COVID-19 outcome. Li *et al.* (2020) indicated similar concerns among healthcare workers in China, as it brought about psychological pressure.

The concerned participants tried their best to adhere to the strict IPC protocols and even went the extra mile by implementing their own safety strategies. Such strategies included changing clothes before reaching home by using scrubs in the workplace. They also minimised close contact with family members as much as possible. To do this, they avoided visits to relatives. They also self-quarantined within their own homes whenever they experienced any COVID-19-related symptoms. They did the same if they felt they might have missed any IPC steps while performing their work duties. This significantly impacted family relations, particularly in situations where physical contact was preferred. In addition to reporting similar findings, Murphy *et al.* (2022) further indicated the stigmatisation of radiology staff, as non-health worker friends and family allegedly avoided social interactions with them due to the perceived risk of contraction from occupational exposure.

In line with the primary appraisal stage of the TMSC (Lazarus and Folkman, 1984), radiology staff perceived their potential exposure to COVID-19 as a threat. They were especially concerned about putting their family members at risk, particularly those who were elderly or had underlying medical conditions. The psychological burden of possibly transmitting the virus to loved ones added to the stress of working with COVID-19 patients. In response to the perceived threat, participants engaged in secondary appraisal, assessing how they could manage the risk. Adopting additional IPC measures, such as changing clothes before reaching home and avoiding close contact with family members, reflects problem-focused coping strategies (Lazarus and Folkman 1984). These efforts illustrate their attempt to control the risk and protect their families despite the inherent challenges of working in close contact with COVID-19 patients. The prolonged avoidance of physical contact with family members, even when necessary to reduce infection risk, had implications for family dynamics and potentially emotional well-being.

6.3.2.6 Disruption of social relations due to social distancing

In addition to disrupted family relations, the participants' social relations within the workplace were severely impacted by the social distancing IPC measures implemented within departments. Mockaitis *et al.* (2022) reported similar findings among participants at different career stages outside the radiology department and highlighted the long-term impact of these disruptions on job satisfaction. Mockaitis *et al.* (2022) added that such disruptions can contribute to employee disengagement and stress.

Participants perceived workplace social distancing and IPC measures as stressors, given their impact on interpersonal connections and workplace culture. This aligns with TMSC's primary appraisal, where individuals evaluate these disruptions as threats to their job satisfaction, engagement, and emotional well-being (Lazarus and Folkman 1984). The inability to modify this IPC protocol, which was mandated to ensure safety, created stress. Participants likely recognised the necessity of such measures, but the lack of

control over the enforced social distancing aligns with TMSC's secondary appraisal of available coping resources (Lazarus and Folkman 1984). The participants may have assessed that adapting to these measures was the only viable coping strategy, though it did not resolve the underlying issue. Prolonged disruption of social connections in the workplace could lead to a sense of isolation and diminished workplace satisfaction, directly affecting stress levels and overall well-being.

6.3.2.7 Researcher's reflection on the theme 'Perceived personal and work-related challenges faced by frontline radiology staff during the COVID-19 era'

The findings of this study contribute to the existing body of knowledge by revealing the complex interplay between individual perceptions, systemic barriers, and external stressors faced by radiology staff during the COVID-19 pandemic. Incorporating the TMSC, HBM, and AT, the study highlights critical institutional inefficiencies, including PPE shortages, outdated equipment, and inconsistent resource allocation, which exacerbated workplace stress. The disparity between public and private radiology departments, where the private sector faced fewer challenges due to better resource management, highlights the systemic inequities within healthcare systems. These insights provide a deeper understanding of how frontline healthcare workers appraise and respond to organisational failures, contributing to the broader discourse on crisis preparedness and healthcare management.

A major contribution of the study lies in its exploration of the long-term physical health challenges experienced by radiology staff, such as fatigue and muscle pain, which align with existing literature on 'long COVID.' (NHS 2023). Unlike general studies on post-recovery symptoms, this research emphasises the compounded impact of physically demanding roles, outdated imaging systems, and underlying medical vulnerabilities, offering a detailed perspective on occupational health risks. This builds on previous findings from SARS and MERS outbreaks (O'Sullivan 2021; Li *et al.* 2023), demonstrating that healthcare workers remain disproportionately affected by prolonged physical

impairments. By contextualising these experiences within radiology departments, the study broadens the understanding of COVID-19's occupational health consequences. It also advocates for improved workplace health interventions tailored to the unique needs of healthcare professionals.

The study also addresses often-overlooked financial hardships experienced by radiology staff, particularly in private practices, where salary reductions, contract terminations, and inadequate management communication exacerbated stress and uncertainty. These findings align with TMSC's primary appraisal of financial instability as a significant threat to well-being, with inadequate organisational support exacerbating the perceived lack of coping resources (Lazarus and Folkman 1984). By linking economic stressors to broader systemic vulnerabilities within private healthcare, the study offers critical insights into the ripple effects of financial instability during pandemics. This contributes to the literature by highlighting the role of proactive communication, trust-building, and financial contingency planning in mitigating economic stress and safeguarding healthcare workers' financial resilience.

The study expands understanding of the social and psychological pressures faced by radiology staff, particularly the emotional toll of balancing family safety with workplace exposure risks. Participants' coping mechanisms, such as physical distancing from loved ones and adherence to strict infection prevention protocols, reflect problem-focused strategies rooted in TMSC (Lazarus and Folkman 1984). However, these measures disrupted family relationships and workplace dynamics, likely leading to feelings of isolation and diminished emotional well-being. The findings highlight the dual burden of occupational and relational stress exacerbated by pandemic protocols. This bridges gaps in the literature by demonstrating how IPC measures, while necessary, impact healthcare professionals' social connectedness and morale. Overall, the study adds to the discussion on work challenges during the pandemic, providing a broad understanding of physical health effects, financial struggles, and emotional stress in radiology settings.

6.3.3 Frontline radiology staff's perceived emotional and psychological experiences when carrying out work duties during the COVID-19 health crisis

Fear of the unknown has been reported in several cases, with a recorded impact on the individual's psychological state (Yu *et al.* 2020; Akyurt 2021; van de Venter *et al.* 2021). The radiology staff under discussion experienced heightened fear of COVID-19, particularly during the early phases. This was a new infection, and most had not experienced a pandemic before. That lack of experience exacerbated their fear. Their anxiety was further intensified by the ever-changing IPC protocols. These changes were due to the novel nature of COVID-19. Staff felt that no one truly knew what was happening or how to adequately protect them while they carried out their duties. A lack of knowledge regarding proper donning and doffing of PPE further heightened their fear. These findings echo the experiences of radiology staff globally (Akudjedu *et al.* 2021; Murphy *et al.* 2022; McFadden *et al.* 2022).

The radiology staff indicated that, in addition to the scarcity of information on the nature of COVID-19, other factors discussed earlier also contributed to their sense of insecurity within their working environment. These factors included a shortage of PPE and inadequate structural spaces, which hindered the full implementation of recommended IPC protocols such as social distancing and the isolation of COVID-19 patients within the radiology department. Although Gauteng radiographers did not report PPE shortages or structural challenges (Lewis and Mulla 2020), several other countries, including those in Africa and the Middle East, did experience PPE shortages (Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Elsami *et al.* 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022). Radiology departments in Hubei province, China, also faced departmental layout and isolation challenges (Yu *et al.* 2020), as indicated by the current study.

Other factors, such as incomplete COVID-19 information disclosure by referring departments, existing underlying medical conditions, and natural circumstances (e.g., pregnancy), further heightened participants' fear. They felt at risk of contracting COVID-19 and potentially experiencing more severe complications. Participants also experienced fear and stress due to the excessive fatality reports associated with the virus. These reports were widely disseminated by the media through daily statistical updates and within their institutions. Hence, these findings align with reports from both local and global studies (Lewis and Mulla 2020; Akudjedu *et al*. 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022). Additionally, radiology staff within public radiology departments felt that management was not empathetic. They believed management did not do enough to ensure their safety in the workplace.

Radiology staff's fear of COVID-19, stemming from its novelty, the lack of information, and ever-changing IPC protocols, aligns with TMSC's primary appraisal, where individuals evaluate stressors as threats to their safety and well-being (Lazarus and Folkman 1984). The unknown nature of the virus and the inconsistencies in guidance heightened their perception of vulnerability, particularly during the pandemic's early phases. Therefore, also aligning with HBM (perceived susceptibility and perceived severity) (Janz and Becker 1984; Rosenstock, Strecher and Becker 1988).

The shortage of PPE, structural challenges, and lack of adequate training on donning and doffing PPE limited the staff's ability to mitigate the perceived threat, reflecting TMSC's secondary appraisal process (Lazarus and Folkman 1984). This could potentially reduce their perceived capacity to cope effectively with the risks. The fear of contracting the virus, exacerbated by factors such as incomplete information and existing vulnerabilities (e.g., pregnancy, underlying conditions), led to heightened stress and psychological strain. TMSC recognises that such emotional responses are a natural outcome of evaluating stressors as unmanageable or life-threatening (Lazarus and Folkman 1984).

Some of the stressors described by radiology staff (e.g., structural challenges, incomplete information) impacted entire departments collectively. The shared nature of these challenges highlights the social dimension of stress.

6.3.3.1 Researcher's reflection on the theme 'Frontline radiology staff's perceived emotional and psychological experiences when carrying out work duties during the COVID-19 health crisis.'

The findings of this study contribute to the existing body of knowledge by illustrating the emotional and psychological impact of the COVID-19 pandemic on frontline radiology staff, particularly their heightened fear of the unknown and feelings of vulnerability. The novelty of the virus, ever-changing IPC protocols, and inadequate training on PPE donning and doffing created a sense of uncertainty and perceived threat, aligning with the primary appraisal of stress described in the TMSC (Lazarus and Folkman 1984). Additionally, several factors compounded their stress. These included PPE shortages, structural challenges in radiology departments, and incomplete information about COVID-19. Participants' personal vulnerabilities, such as underlying conditions or pregnancy, also played a role. Together, these factors further reflected limitations in their secondary appraisals of coping resources. This study highlights the nature of radiology staff's experiences, echoing but also expanding on findings from global contexts by situating them within a resource-constrained setting, particularly in public healthcare systems.

The findings highlight that stressors such as systemic challenges, departmental layout constraints, and incomplete information dissemination were collective in nature, affecting entire radiology departments. This highlights a dimension of stress that extends beyond individual coping mechanisms and points to broader organisational gaps. Radiology staff in public departments, in particular, expressed feeling unsupported and unsafe, emphasising the critical need for empathetic leadership, adequate resources, and clear communication during crises. By bridging the gap between individual emotional responses and systemic shortcomings, this study provides an exploration of the psychological

burden faced by frontline radiology staff, offering valuable insights for improving institutional preparedness and staff well-being in future health crises.

6.3.4 Perceived influences of COVID-19 and its related consequences on the frontline radiology staff's mental well-being

Physical, emotional, and psychological feelings experienced during the course of their professional duties directly impacted participants' emotional and mental states. This impact manifested in emotional strain and emotional exhaustion, with participants feeling at times that they could not continue. The severity of the virus, combined with challenges faced within departments, reportedly caused strain and exhaustion. The unknown nature of the virus, inexperience in dealing with such a virus, lack of managerial support, the need to protect family members, and challenges in implementing IPC protocols led participants to feel paranoid when attending to either PUI or COVID-19 patients. They were afraid of contracting the virus. Additionally, seeing fellow colleagues contract the virus further exacerbated these emotional impacts. Participants reported anxiety, paranoia, and stress as significant issues during this period.

These findings align with worldwide studies that have reported the significant impact of COVID-19 and its related consequences on the mental well-being of radiology staff, with anxiety being the most common finding (Lewis and Mulla 2020; Akudjedu *et al.* 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; Murphy *et al.* 2022). An Ireland-based mixed-method study further illustrated that, among other COVID-19 effects, mental health was the most significant impact. This was evidenced by pre- and post-COVID-19 data (Figure 2.3; Murphy *et al.* 2022).

Locally, van de Venter *et al.* (2021) recorded elevated coronavirus anxiety scale scores among South African-based radiographers. However, the causes of these high scores were not explored due to the limiting nature of the chosen method. As part of the experienced mental effects, participants in the current study reported feeling demoralised or demotivated by the lack of recognition for

their professions as frontline healthcare workers. They also emphasised the need for adequate PPE when carrying out their duties.

The frontline radiology staff interpreted the stressor (COVID-19 and effects) to be either positive, dangerous or irrelevant based on several factors such as their perceived safety (perceived susceptibility) from infection while working in a radiology department amidst a pandemic. Thus, aligning with HBM (Janz and Becker (1984); Rosenstock, Strecher and Becker (1988) and TMSC's primary appraisal concept (Lazarus and Folkman 1984). Participants who faced PPE and staff shortages, structural and IPC implementation challenges (situational or external attribution) were perceived to be highly susceptible to contracting the virus while conducting their duties. Thus, conforming to the concepts of HBM and AT (Janz and Becker 1984; Palmier and Peterson 2009).

Additionally, in keeping with AT, radiology staff's personal challenges, such as uncontrolled anxiety presented as internal attribution (Mcleod 2023). Underlying medical conditions made participants feel they were prone to developing severe COVID-19 symptoms while working in high-risk COVID-19 environments (perceived severity). Thereby corresponding with AT and HBM (Janz and Becker 1984; Palmier and Peterson 2009). In alignment with TMSC, a single radiology worker at a managerial level in a private healthcare setting perceived the situation not to be stressful due to previous experience of working in a highly infectious situation (Biggs, Brough and Drummond 2017).

However, in keeping with TMSC, most of the participants perceived the situation to be dangerous and challenging, leading to the second appraisal (Biggs, Brough and Drummond 2017). Aligning with TMSC's second appraisal concept, the radiology staff appraised the situation based on an analysis of available resources to protect themselves from infection while carrying out their duties. These resources included PPE availability, IPC protocol training, and updated information on COVID-19. The staff also considered adequate staffing to ensure the distribution of the increasing workload, managerial support,

continued full salaries, family and colleague support, and the availability of feasible coping resources (Biggs, Brough and Drummond 2017).

Many of the participants raised concerns around the unavailability of most of these resources, resulting in detrimental physical, social and mental health effects, thereby conforming with TMSC (Lazarus and Folkman 1984). These constraints potentially diminished their sense of control and intensified feelings of helplessness and exhaustion. The mental health outcomes reported, including emotional exhaustion, anxiety, and paranoia, are consistent with TMSC's acknowledgement of stress-related emotional responses when stressors outweigh coping resources (Lazarus and Folkman 1984).

6.3.4.1 Researcher's reflection on the theme 'Perceived influences of COVID-19 and its related consequences on the frontline radiology staff's mental well-being.'

The findings of this study contribute meaningfully to the existing body of knowledge by providing a detailed understanding of the mental health effects experienced by frontline radiology staff during the COVID-19 pandemic. Emotional exhaustion, anxiety, and paranoia emerged as dominant themes, driven by factors such as PPE shortages, structural challenges hindering IPC protocols, and fear of infection due to the unknown nature of the virus. Aligning with the TMSC, participants' primary appraisal of COVID-19 as a dangerous and unmanageable stressor was exacerbated by inadequate coping resources during the secondary appraisal process (Lazarus and Folkman 1984). The heightened perceived susceptibility and severity of infection align with the HBM (Janz and Becker 1984). The severity was worsened by systemic failures, lack of managerial support, and pre-existing vulnerabilities such as underlying health conditions. These findings align with global studies while offering a local perspective that highlights the connection between emotional stress, systemic issues, and individual coping challenges.

Moreover, the study highlights important differences in stress responses based on external factors (e.g., resource limitations and situational challenges) versus internal factors (e.g., anxiety and fear of vulnerability), as explained by AT (Palmier and Peterson 2009). While most participants perceived the situation as dangerous, one radiology staff member with prior experience in infectious environments viewed it as non-stressful, showing how past experience can influence how individuals cope. The mental health outcomes reported here – demoralisation, emotional strain, and feelings of helplessness – match TMSC's recognition of stress-related emotional reactions when coping resources are lacking (Lazarus and Folkman 1984). By identifying the barriers and emotional impact unique to radiology staff, this study advances the conversation on pandemic-related occupational stress and highlights the urgent need for targeted interventions, such as better managerial support, resource availability, and mental health programs to build resilience and reduce the impact of future crises.

6.3.5 Perceived influence of the resultant mental health status of frontline radiology staff on their professional competence during the pandemic era

The participants' resultant mental health status, which included fear, anxiety, stress, emotional strain, emotional exhaustion, and paranoia, reportedly impacted their work attendance. This was evident through absenteeism and the avoidance of work responsibilities associated with working in close contact with COVID-19 patients. These issues contributed to staff shortages due to repeated sick leave. Participants went to great lengths to find ways to call in sick. Some prolonged the quarantine period while awaiting COVID-19 results, while others requested an extension of their sick leave to avoid being within a COVID-19 working environment.

This situation severely impacted the remaining staff, who were left to face the increased workload on their own. As a result, their professional competence was affected, as they focused more on pushing the patient numbers rather than

maintaining the quality of service. Considering the accuracy and precision required in radiology, this could potentially impact the adequacy of the images obtained and the accuracy of the radiological reporting. Unaddressed mental stressors among radiology staff have been linked to poor service delivery and inaccurate radiological diagnoses (Gam 2015; Fishman *et al.* 2018).

Additionally, the participants' mental health status impacted their interaction with patients. They subconsciously or consciously reduced contact time as a way of minimising exposure to the virus. Participants reduced interaction and communication with patients due to the airborne nature of COVID-19 (CDC 2023a). This was particularly the case with patients who resisted wearing masks. However, at some point in South Africa, it became illegal not to wear a mask (NDoH 2020b). The resulting mental health status also impacted participants' adherence to IPC protocols, as they felt mentally and emotionally exhausted. These findings align with those of Murphy *et al.* (2022) and Swaminathan, Mukundadura, and Prasad (2022), who reported complaints regarding PPE usage. Radiology staff felt overwhelmed by the strict protocols, along with the physical strain of prolonged PPE use.

In keeping with AT, which states that certain behaviours can be caused by an external influence known as situational or external attribution (Mcleod 2023), some radiology staff perceived stress, fear, and anxiety from working in a COVID-19 infectious environment. They believed these feelings, along with related consequences, impacted their professional competence. This was reflected in reduced time spent interacting with patients, non-adherence to IPC protocols, absenteeism, and avoiding work responsibilities and duties. This aligns with TMSC's primary appraisal with most of the radiology staff perceiving the situation and environment as threatening or harmful to them (Lazarus and Folkman 1984).

On the other hand, the findings do not align with internal attribution, which attributes individuals' behaviours to their personal characteristics (RHIH 2018). None of the radiology staff indicated that reduced patient interaction times and

absenteeism were due to their personal attributes. This can be cross-referenced by checking records of staff performance and attendance before and after COVID-19, which is beyond the scope of this study. This process aligns with TMSC's secondary appraisal. Radiology staff behaviours, such as absenteeism and avoidance, reflect a lack of confidence in their ability to manage the stressors (Lazarus and Folkman 1984). The mental and emotional exhaustion reported aligns with TMSC, which predicts emotional strain when stressors persist and coping resources are insufficient (Lazarus and Folkman 1984). This potentially explains the compromised adherence to protocols and reduced patient interaction.

6.3.5.1 Researcher's reflection on the theme 'Perceived influence of the resultant mental health status of frontline radiology staff on their professional competence during the pandemic era.'

The findings of this study contribute to the existing body of knowledge by demonstrating how the mental health challenges faced by frontline radiology staff during the COVID-19 pandemic, such as fear, anxiety, stress, and emotional exhaustion, negatively impacted their professional competence. Participants reported increased absenteeism, avoidance of COVID-19-related duties, and reduced patient interaction as coping mechanisms to mitigate perceived risks, aligning with AT and the TMSC (Lazarus and Folkman 1984; Palmier and Peterson 2009).

The situational stressors, including high infection risks and strict IPC protocols, often led to reduced adherence to safety guidelines, compromised patient care, and a focus on managing workload rather than maintaining accuracy, which is crucial in radiology. These findings highlight how unaddressed mental health stressors can directly affect service delivery, with potential consequences for radiological imaging accuracy and diagnostic outcomes. This study highlights the connection between mental well-being, workplace stressors, and professional performance. It calls attention to the urgent need for mental health support, targeted interventions, and organisational changes. These measures

are necessary to safeguard the competence and well-being of frontline radiology staff during health crises.

6.3.6 Strategies for dealing with COVID-19 related mental distress

Lazarus and Folkman's TMSC (1984) views stress as a dynamic interaction between individuals and their environment, where the ability to cope plays a crucial role. A pre-pandemic study indicated that solution-focused strategies, such as restructuring shifts, were effective in managing workplace stress within the radiology department (Ashong *et al.* 2016). However, in keeping with other studies, the current findings highlight that during the COVID-19 pandemic, there was a shift toward emotion-focused coping due to challenges that hindered the effectiveness of solution-focused strategies. These included reliance on acceptance, social coping, and passive strategies like self-distraction (Abdullah *et al*. 2023; Shahid *et al*. 2022).

The current study highlights the complexity of stress management in healthcare settings during a crisis. In line with Cooper *et al.* (2006) and Ugwu, Ahamefule and Nwobi (2008), who argued against a 'one-size-fits-all' approach to coping, the findings provide critical insights into the specific needs and preferences of eThekwini radiology staff. This data forms a valuable foundation for tailored recommendations aimed at supporting this workforce in future health crises. Additionally, it contributes baseline data in support of South Africa's mental health policy (MHP) to promote mental well-being across the population (Lund 2023).

The eThekwini radiology staff demonstrated remarkable adaptability and professional resilience, consistent with findings from global studies (Lewis and Mulla 2020; Chinene 2023; Akudjedu *et al*. 2021). In alignment with TMSC, they adopted both problem-focused and emotion-focused coping strategies to manage COVID-19's mental health impacts (Lazarus and Folkman 1984). Problem-focused strategies included adaptive behavioural approaches, occupation-centred coping (escape-avoidance), and practical solutions to

address workplace stressors. Such methods were instrumental in mitigating workplace challenges, either short-term or long-term (Lazarus and Folkman 1984; Cooper *et al*. 2006).

Similar patterns were observed among radiology personnel in Ghana and Nigeria, who prioritised work adaptations and job redesign (Ashong *et al.* 2016; Omidiji *et al*. 2022). For example, redesigned rosters during the pandemic minimised exposure risks while ensuring service continuity. This also aligns with Oleaga's (2020) COVID-19 recommendations for radiology departments, to take lessons from it and adopt procedures to match any potential future health crises. The redesigning of rosters to minimise repeated exposure to the virus and ensure continuous service delivery allowed radiology staff to have family support when not on duty, therefore aligning with findings in Pakistan (Shahid *et al*. 2022).

The introduction of the COVID-19 vaccine brought some relief enabling the radiology staff to feel safer while conducting their duties. Similar to Shahid *et al.* 2022), solutions to staff shortages were beyond the radiology staff's capability. Therefore, they relied on teamwork to cope with the increased workload. Teamwork is an imperative attribute within healthcare departments; hence, the participants' practice was commendable. On the other hand, some frontline radiology staff turned to maladaptive coping strategies, which did not align with expected healthcare workers' professional behaviours. This included avoiding duties involving close contact with COVID-19 patients, making it a finding unique to the eThekwini radiology staff. To cope with salary cuts, some staff used their savings and cancelled plans. This was understandable considering that most travel had been banned due to lockdowns. However, the use of savings was detrimental. Financial intervention or relief efforts by the employer would have been beneficial in demonstrating support for their staff, which, according to Makanjee, Hartzer and Uys (2006), influences staff retention.

Although according to the TMSC, problem-focused coping seeks to eliminate or manage the stressor (Lazarus and Folkman 1984), it was not feasible for all the challenges due to factors beyond the individual's control. Hence, frontline radiology staff had to change their response to the stressors (Lazarus and Folkman 1984; Mcleod 2023). In this regard, radiology staff practised accepting professional responsibilities and duties, appraisal-focused coping, social coping, spiritual therapy, exercise, and reading, and at times did not take any action at all. These secondary intervention strategies aligned with the TMSC (Lazarus and Folkman 1984), Cooper *et al*. (2006) and findings among other radiology staff (Woerner *et al.* 2021; Fennessy *et al.* 2021). This coping method is considered a powerful choice and potentially aids in developing emotional resilience, as reported among Gauteng-based radiographers (Lewis and Mulla 2020).

Radiographers in private radiology departments within the eThekwini district found managerial support very beneficial. Thereby, corroborating findings that perceive organisational support as a foster of positive working environments, staff retention and job performance among radiographers (Makanjee, Hartzer and Uys 2006). The current findings align with Gam (2015), who also reported that public radiology staff in the eThekwini district reported non-supportive management prior to COVID-19. This highlights a gap that needs to be addressed and considered when developing recommendations for this staff.

Some of the eThekwini radiology staff reported venting as a coping strategy. There are views of positive venting being beneficial in opposition to negative venting, which is considered a dysfunctional intervention (Cooper *et al.* 2006). Nevertheless, the current findings are not uncommon as radiology staff in some parts of the world reportedly adopted dysfunctional coping styles. This included increased sedentary patterns, self-distraction, increased screen time, caffeine, and alcohol intake (Murphy *et al.* 2022; Abdullah *et al.* 2023). Although the radiology staff were aware of available tertiary interventions such as psychological counselling, none of the participants made use of the resources as they perceived other options to be more beneficial.

The differences in adopted coping strategies could be attributed to different circumstances and individual preferences (Lazarus and Folkman 1984; Cooper *et al*. 2006). Considering how volatile the situation was, frontline radiology staff adopted coping strategies with the potential for rapid outcomes. Therefore, outcomes were most likely short-term (Lazarus and Folkman 1984). Since the study was not longitudinal, the possible long-term effects of their coping efforts are unknown at this point. In keeping with TMSC, the process was a loop as frontline radiology staff repeatedly interacted with the dynamic stressors (COVID-19 and consequences). Thereby reappraising the outcome of their coping efforts from time to time (Lazarus and Folkman 1984). This resonates with other studies indicating increased effectiveness of regularly adapting coping mechanisms (Ashong *et al.* 2016; Abdullah *et al.* 2023).

6.3.6.1 Researcher's reflection on the theme 'Strategies for dealing with COVID-19 related mental distress.'

The findings of this study contribute to the existing body of knowledge by offering valuable insights into how frontline radiology staff in eThekwini handled mental distress during the COVID-19 pandemic. While pre-pandemic studies emphasised solution-focused strategies, the current findings reveal a shift towards emotion-focused coping mechanisms due to the overwhelming challenges of the pandemic. This included reliance on strategies such as acceptance, social coping, and self-distraction, as the typical solution-focused approaches were hindered by factors beyond the staff's control. This shift highlights the need for a more detailed understanding of stress management in healthcare settings, especially in crisis situations, where adaptive and emotion-focused strategies are often more effective than traditional problem-focused approaches. The findings provide a foundation for developing tailored coping interventions for radiology staff, emphasising the need for flexibility in addressing their specific needs.

This study also aligns with international research on the adaptability and resilience of healthcare professionals during a crisis, showing that eThekwini radiology staff, such as their peers globally, demonstrated significant professional endurance (Omidiji *et al*. 2022). Their coping strategies included both problem-focused approaches, such as work adaptations and practical solutions, and emotion-focused strategies to manage the psychological impact of the pandemic. These methods proved essential in reducing workplace stress, though they were often temporary. The study also echoes findings from other countries such as Pakistan and Nigeria, where work adaptations such as redesigned rosters were used to minimise exposure to COVID-19 and ensure continuous service delivery (Shahid *et al*. 2022; Omidiji *et al*. 2022). These global similarities highlight the importance of structural and operational changes as part of a comprehensive approach to mental well-being during health crises.

In addition to these strategies, the findings highlight the significance of organisational support, particularly managerial backing, in helping radiology staff manage mental distress. While staff in private radiology departments reported benefiting from strong managerial support, those in public settings felt a lack of support, which exacerbated their stress. This gap in organisational support, particularly in public healthcare settings, highlights a critical area for improvement. Ensuring adequate managerial support could foster a more positive working environment and enhance staff resilience. Thereby improving both mental health and job performance (Makanjee, Hartzer and Uys 2006; Ismail, Shiner and Tucker 2024).

However, the study also revealed the limitations of certain coping strategies, such as maladaptive behaviours like avoidance of work duties and the use of personal savings to cope with financial stress. These findings point to the importance of comprehensive support systems, including financial relief and targeted mental health interventions, to ensure the well-being of radiology staff during future health crises. Although some staff were aware of available psychological counselling resources, many did not utilise them, opting for other

coping mechanisms that provided more immediate relief. This calls for a re-evaluation of mental health resources, emphasising accessibility and addressing the specific preferences of healthcare workers.

6.3.7 Strategies to support frontline radiology staff in addressing mental health challenges during a health crisis

Bridger, Morton and Day (2013) highlighted that research has shown the absence of coping resources and support results in poor staff retention, as employees escape unresolved stressors. Several coping mechanisms exist in the literature. However, as argued by Cooper (2005), stress does not respond well to a 'one size fits all' coping mechanism. Hence, as indicated by Ugwu, Ahamefule, and Nwobi (2008), developing a tailored mental coping mechanism has been shown to improve mental wellness. In line with this, the participants' voices were captured to provide a strong foundation for developing mental health coping recommendations aligned with the study population's unique experiences and circumstances.

Based on the findings, participants view emotion-based interventions, problem-based approaches, support-based interventions, and the availability of a platform to vent as cornerstones in addressing mental health challenges during a health crisis, such as the COVID-19 pandemic. These findings align with Lazarus and Folkman (1984), who suggested that changing the situation (problem-based coping) and altering one's relation to the situation (emotion-focused coping) can lead to successful management of mental effects or stress.

Although participants reported venting as a coping strategy, Cooper *et al.* (2006) regarded this as one of the dysfunctional coping strategies. Nevertheless, the current findings are not unique. Radiology staff in some parts of the world reportedly also adopted dysfunctional coping styles to manage the increased stress and demands of working in radiology departments during the COVID-19 pandemic. These strategies included increased sedentary

behaviour, higher caffeine intake, and more screen time when not working (Murphy *et al*. 2022).

The radiology staff's endorsement of emotion-based and problem-based approaches reflects the coping strategies described by Lazarus and Folkman (1984). According to TMSC, effective stress management requires appraising a stressor and applying either emotion-based or problem-based strategies based on the controllability of the situation. The findings also emphasise that both types of coping can contribute to the successful management of stress, which is a core principle of TMSC (Lazarus and Folkman 1984).

6.3.7.1 Researcher's reflection on the theme 'Strategies to support frontline radiology staff in addressing mental health challenges during a health crisis.'

The findings of this study significantly contribute to the existing body of knowledge by providing practical insights into effective strategies for supporting frontline radiology staff in managing mental health challenges during a health crisis, such as the COVID-19 pandemic. The study highlights the importance of a multi-faceted approach to stress management, with participants emphasising the need for emotion-based strategies, problem-based coping strategies, support systems, and platforms for venting – aligning with the TMSC (Lazarus and Folkman 1984). The participants' preferences for different coping mechanisms further emphasise the need for personalised approaches to mental well-being in healthcare settings, as opposed to a one-size-fits-all solution.

Moreover, the study strengthens the idea that coping strategies should be flexible to meet the specific needs of the workforce, as shown by the participants' support for various methods, including venting, even though Cooper *et al*. (2006) considered it a potentially harmful coping strategy. This reflects a wider global trend where radiology staff, overwhelmed by the pressures of the pandemic, turned to both helpful and harmful strategies to cope. The findings highlight the need for institutions to consider a wide range

of coping resources, from practical solutions to emotional support, to improve staff resilience and retention. This adds to the growing understanding that supporting healthcare workers requires a complete, context-specific approach, including both personal and organisational strategies to reduce stress and encourage mental wellness.

6.4 SUMMARY OF THE CHAPTER

A comprehensive interpretation of the research findings was provided, comparing them with existing literature and key concepts from the study's theoretical framework (Modified TMSC incorporating HBM and AT). Furthermore, the discussion reflected on the applicability and relevance of the theoretical framework in understanding the research problem and explaining the observed phenomena. The chapter also critically discussed the broader significance of the study's findings, considering their practical and theoretical contributions to the body of knowledge and practice within radiology departments during health crises.

CHAPTER 7: THE FRONTLINE RADIOLOGY STAFF MENTAL SUPPORT FRAMEWORK

7.1 INTRODUCTION

The study aimed to explore the mental health and well-being experiences of frontline radiology staff during a health crisis, specifically, the COVID-19 pandemic. So far, part of the research questions (Questions 1-5) outlined in Table 7.1 have been addressed. These questions have been analysed in relation to existing literature and the adopted theoretical framework, the modified TMSC, incorporating HBM and AT, discussed in previous chapters. Evidence shows that frontline radiology staff in the eThekwini district of KZN faced mental health challenges, such as stress, fear, and anxiety. However, the sixth research question remains to be addressed:

'What practical recommendations can be developed to support the mental health and well-being of frontline radiology staff during health crises, based on their experiences during COVID-19?'

This chapter aims to outline the development process and present a proposed framework to support frontline radiology staff in addressing mental health challenges during health crises.

Table 7.1: Research findings

Research question	Major findings
1. What professional duties and roles did frontline radiology staff undertake during the COVID-19 pandemic in the eThekwini district?	• Profession-specific clinical duties and patient care. • Radiation protection: justification of exposure and dose optimisation. • Infection prevention and control. • Management. • Administrative duties. • Use of general x-rays and CT in the management of COVID-19 patients.
2. What personal and work-related challenges did frontline radiology staff experience during the COVID-19 pandemic?	• Unpreparedness and perceived increased risk of infection. • Adaptation to changes in systems, protocols and structures in response to the pandemic. • Information about COVID-19. • Physical health. • Financial hardships due to the pandemic. • Social shielding responsibility for family members. • Disruption of social relations due to social distancing.
3. How do radiology staff in the eThekwini district perceive and describe their experiences of mental health and well-being during the COVID-19 pandemic?	• Fear of the unknown disease. • Fear of contracting COVID-19.
4. How do radiology staff in the eThekwini district perceive and describe the impact of COVID-19 and its related consequences on their mental health, well-being, and professional competence?	• Emotional strain. • Mental health challenges. • Attendance. • Patient care and interaction. • Adherence to protocols.
5. What coping strategies did frontline radiology staff adopt to manage COVID-19-related mental distress?	• Emotion-focused coping. • Problem-focused coping. • Barriers to coping: work-related, lack of support or recognition, personal factors and colleagues.

7.2 DEVELOPMENT OF THE FRONTLINE RADIOLOGY STAFF MENTAL HEALTH SUPPORT FRAMEWORK

Defined as an overview structure of concepts, constructs, variables and their relations, frameworks are formulated for several purposes. This includes paving a way for implementing research in practice or as a form of addressing a challenge (Nilsen 2015). Concurring with Baker and Young (2016) (Figure 7.1) and Walker and Avant (2011), theory development is an essential part of practice. Despite health institutions rewarding employees based on 'getting the job done,' it is important to get the job done in the best way that aligns with the required quality of care and evidence-based practice. Like other professions, the radiology department requires theory development and establishment of a

solid body of knowledge as a source of raw materials (Figure 7.1) (Walker and Avant 2011; Baker and Young 2016).

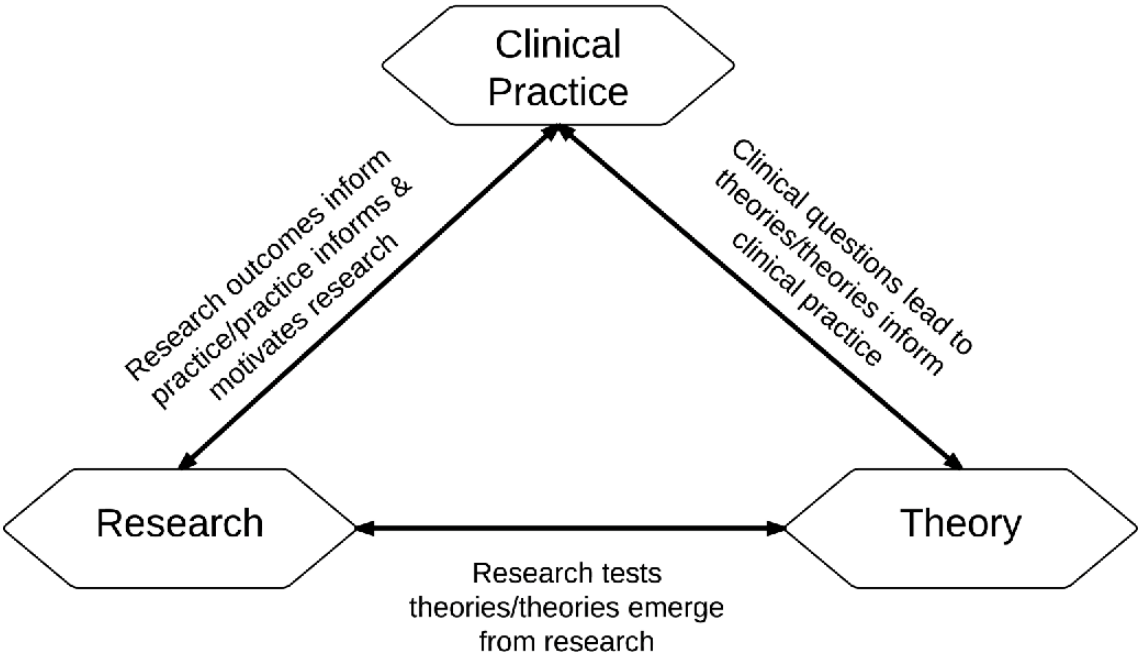

Figure 7.1: Dynamic relationships among research, theory and practice (Baker and Young 2012).

Similar to nursing, radiology is also a practice discipline or department. Therefore, developing the proposed framework allowed for the identification and expression of key factors and core values impacting practice – occupational stress and mental-coping (Walker and Avant 2011). Occupational stress among frontline radiology staff has been an ongoing issue with reported exacerbation in various geographical locations, including South Africa, during health crises such as COVID-19 (Gam 2015; Lewis and Mulla 2020; Akudjedu *et al*. 2020; Shanahan and Akudjedu 2021; Akudjedu *et al.* 2021; van de Venter *et al.* 2021; Murphy *et al.* 2022). Therefore, as indicated by Ugwu, Ahamefule and Nwobi (2008) and van de Venter *et al.* (2021), it is imperative that an interventional framework that is tailor-made for the radiology department be formulated to assist staff with mental health-coping during health crises.

Considering that frameworks inform and guide research and practice (Nilsen 2015), it is imperative that a rigorous process be followed during their development. As such, both deductive and inductive reasoning processes were utilised to reach the proposed framework. This was achieved through the incorporation of the research findings, adapted theoretical frameworks, and existing literature (Figure 7.2).

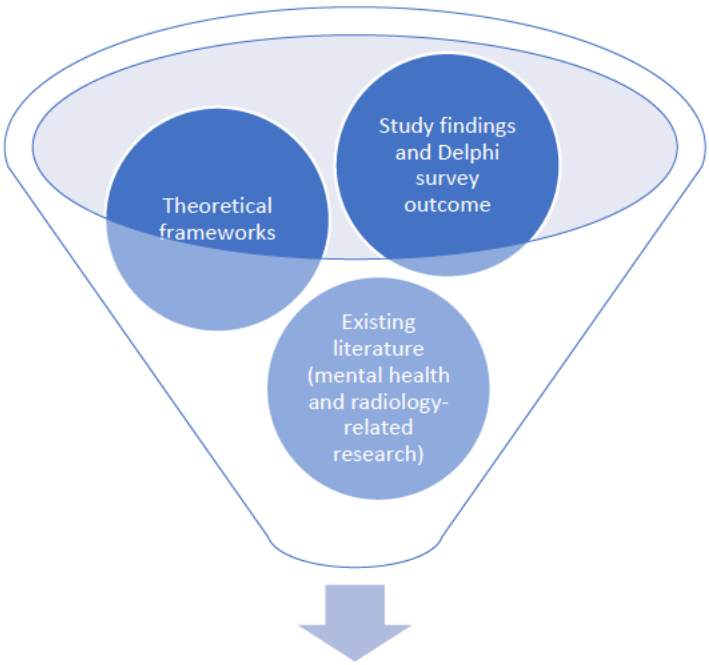

Figure 7.2: Mental health support framework development process.

Due to the dearth of literature guiding framework development and mental-health related theories in radiology, the study's theoretical framework developed in chapter 3 comprising concepts from TMSC, HBM and AT were adapted through the process of derivation (Walker and Avant 2011). This involved redefining of concepts and relational statements to align with the study findings, literature and discipline-specific aspects (Walker and Avant 2011). According to Chinn and Kramer (2018), developing conceptual meaning, structuring and contextualising the theory are steps in structuring empirical

phenomena and theory development. In alignment with Walker and Avant's (2011) concept analysis and Chinn and Kramer's (2018) theory development process, four broad steps were involved in the development of the current mental-coping framework as follows:

7.2.1 Identifying and defining concepts

Defined as, *'complex mental formulation of experience'* (Chinn and Kramer 2018), concepts together with statements and theories are the three elements of theory construction (Walker and Avant 2011). Conducted as part of concept analysis (Walker and Avant 2011), identification of concepts and development of conceptual meaning are building blocks for theory development (Chinn and Kramer 2018). These concepts can be derived from life experiences, practice, literature, research or conceptual meaning processes (Chinn and Kramer 2018). Concepts have variable abstract levels that align with the theory level (Chinn and Kramer 2018). Hence, for the framework under discussion, which is at the practice theory level, several concepts were considered concrete and of suitable depth. These include health crisis, filters, experiences of radiology staff, sensemaking, evaluation of coping resource availability, coping and support, barriers, outcomes, and reappraisal.

With the aid of the adopted framework (modified TMSC incorporating HBM and AT), research findings, and previous research, possible structures of the relationships between the concepts emerged. Concepts became clearer, and their meanings were established through the creation of conceptual meaning as part of concept analysis (Ugwu, Ahamefule and Nwobi 2008; Walker and Avant 2011; Chinn and Kramer 2018). This is further elaborated by Nurse Key (2017), who outlined that conceptual meaning or definition involves developing connotative definitions of concepts. These definitions provide a deeper understanding that is contextualised to a specific theory and offers an operational meaning.

During concept analysis, based on the idea of linear time, relationships between concepts and their forecast within a linear time frame result in four categories of concepts: antecedent, coincident, intervening, and consequent (Walker and Avant 2011; Chinn and Kramer 2004). Antecedent concepts are defined by Yazdani, Hosseini and Ahmady (2016) as incidents that happen before the occurrence of the concept under discussion. These concepts can have a causal relationship with those that follow (Chinn and Kramer 2004). For example, health crises and the experiences of frontline radiology staff influence their sensemaking of the situation (e.g., stressful, irrelevant, or positive) (Figure 7.3). As a result, they were considered antecedent concepts for the current mental-coping framework. Health crises were noted as independent variables, as they are not influenced by any of the other concepts. Health crises and the experiences of radiology staff (i.e., radiology staff's lived experience of the health crisis) (Figure 7.3) occur simultaneously. Therefore, they were categorised as coincident concepts (Chinn and Kramer 2004).

Categorised as being coincident, intervening concepts are defined by Chinn and Kramer (2018) as those concepts that have an impact on the relationships among concepts in a theory. Chinn and Kramer (2004) added that intervening concepts can potentially influence the relationships between antecedent concepts, the experienced event, and its consequents. For the current framework, filters and internal and external influences were categorised as intervening concepts. These factors impact the relationship between health crises and the experiences of radiology staff, as well as the sensemaking process (Figure 7.3). Yazdani, Hosseini, and Ahmady (2016) described consequent concepts as those that result from the occurrence of another concept. For instance, a negative sensemaking outcome (the situation is stressful) results from the negative experiences of radiology staff during the health crisis (stressor) (Figure 7.3). This, therefore, implies causation (Chinn and Kramer, 2004).

7.2.2 Identifying assumptions as part of the framework

Alternatively known as presumptions, assumptions are described by Cambridge University Press and Assessment (2023) as a phenomenon accepted as being true even though there is no proof. Chinn and Kramer (2018) indicated that although underlying assumptions can be stated, implied, or not stated, they nevertheless influence the foundation of the theory. They also affect its structuring and contextualising.

For the current framework, which emanates from the TMSC, it was assumed that human beings (frontline radiology staff) interact with their environment (radiology departments and other related working environments) and situations (health crises). Additionally, it was assumed that there are causal connections among the various concepts of the framework (Figure 7.3) (Lazarus and Folkman 1984; Chinn and Kramer 2018).

7.2.3 Clarifying the context of the framework

Chinn and Kramer (2018) stated that for theory to be useful in practice, it is imperative that the theoretical relationships are contextualised. They further argue that clarifying the context of these theoretical relationships helps establish boundaries within which the theory or framework is applicable (Chinn and Kramer 2018).

The current mental-coping framework falls under the category of situation-specific theories (Chinn and Kramer 2018). It is contextualised to health crises and is applicable within radiology departments across three professions: radiographers, radiologists, and nurses. This framework, based on radiology staff's experiences during COVID-19, would be adopted by radiology departments during planning stages, employee awareness programs, or mental wellness initiatives. It could also be used during the health crisis phases. Furthermore, the framework may be adopted in the late stages of the health crisis or post-crisis to assist staff in managing any post-traumatic stress disorder (PTSD).

7.2.4 Designing relationship statements

Following the establishment of the concepts, assumptions, and contextualisation of the framework, it was imperative to develop relationship statements between concepts. These statements were necessary to explain and predict the interactions of the concepts within the framework (Chinn and Kramer 2018). When constructing theories, statements can be broadly categorised into either relational or nonrelational statements. Relational statements indicate a correlation or causality between or among concepts (Walker and Avant 2011; Nurse Key 2017).

Correlational statements, also known as associational statements, outline concepts that occur simultaneously. They determine whether one concept has a positive, negative, or no effect on the other (Walker and Avant 2011). For instance, adopting the most suitable mental-coping strategy and obtaining the relevant departmental support can result in positive short-term or long-term outcomes. Walker and Avant (2011) pointed out that causal statements elaborate on the cause-and-effect relationship among concepts. For example, negative experiences of radiology staff during a health crisis can negatively influence the sensemaking process, resulting in a negative output (the situation becomes stressful).

On the other hand, nonrelational statements outline how theorists elaborate definitions and meaning within the theory, according to Walker and Avant (2011). These include existence statements, which are basic statements that claim the existence of a concept (Walker and Avant 2011; Nurse Key 2017). For example, coping and support are psychological phenomena.

The following relationship statements emerged:

- Frontline radiology staff's experiences during health crises are influenced by filters (internal and external factors).

- Frontline radiology staff's experiences during health crises influence sensemaking (i.e. determining whether the situation is stressful, irrelevant or positive).
- Negative experiences during the health crisis impact mental well-being negatively, resulting in a negative sensemaking output (situation is stressful).
- Positive experiences during the health crisis impact mental well-being positively, resulting in a positive sensemaking output (situation is inspiring).
- Neutral experiences during the health crisis have no impact on mental health, resulting in a neutral sensemaking output (situation is irrelevant).
- Negative output of sensemaking (stressful) calls for the need for the evaluation of coping resource availability.
- Insufficient coping resources result in the need to adopt the coping strategies and accept the support offered by the department or institution.
- Adoption of coping strategies results in either positive or negative outcomes.
- Barriers negatively influence coping and support strategies.
- Addressing barriers is likely to result in positive outcomes of the coping strategies.
- Regardless of the outcome of adopting coping and support strategies, individuals can return to the coping and support phase for either improvement or adoption of another strategy.
- Following a negative outcome, the experiences and the evaluation of coping resource availability can be reassessed through reappraisal. This helps establish which coping and support strategies can be adopted for the improvement of mental well-being.

7.2.5 Validating the framework with the Delphi method

As outlined in Chapter 4, to validate the developed frontline radiology staff mental health support framework, a Delphi survey was conducted. In this study, 10 radiology experts critiqued the framework to ensure it was relevant to the

target population and aligned with expert opinions in the field. Participants were purposefully selected for their expertise, including eight PhD holders with significant experience in research, teaching, and learning, and two eThekwini-based Radiography managers, one of whom also held a PhD. The academic participants represented both South African and international institutions, ensuring diverse perspectives.

Participants found the framework invaluable for the radiology department. This is because there are no known tailor-made coping frameworks specifically aimed at radiology departments. This is despite the impacts of health crises, particularly COVID-19, on the mental well-being of frontline radiology staff. The concepts in the framework were also noted as relevant. Participants suggested that more concepts be introduced to provide ongoing support for staff who report a positive or neutral outcome following the sensemaking process. This process evaluates whether staff find the situation stressful or not.

Additionally, suggestions were made for the framework to clearly outline the 'what' and 'how' of the support provided to frontline radiology staff. This included specifying the support offered at both the individual and department levels, as well as how it would be implemented or provided. Participants also suggested incorporating the Regression model to account for any regression among staff and departments at various points in the process. As a result, double arrow lines were added at several stages of the framework. After analysing the suggestions and further evaluation, the finalised framework was completed and is presented in Figure 7.3.

7.3 DESCRIPTION OF THE FRONTLINE RADIOLOGY STAFF MENTAL HEALTH SUPPORT FRAMEWORK

The frontline radiology staff mental health support framework is presented in Figure 7.3.

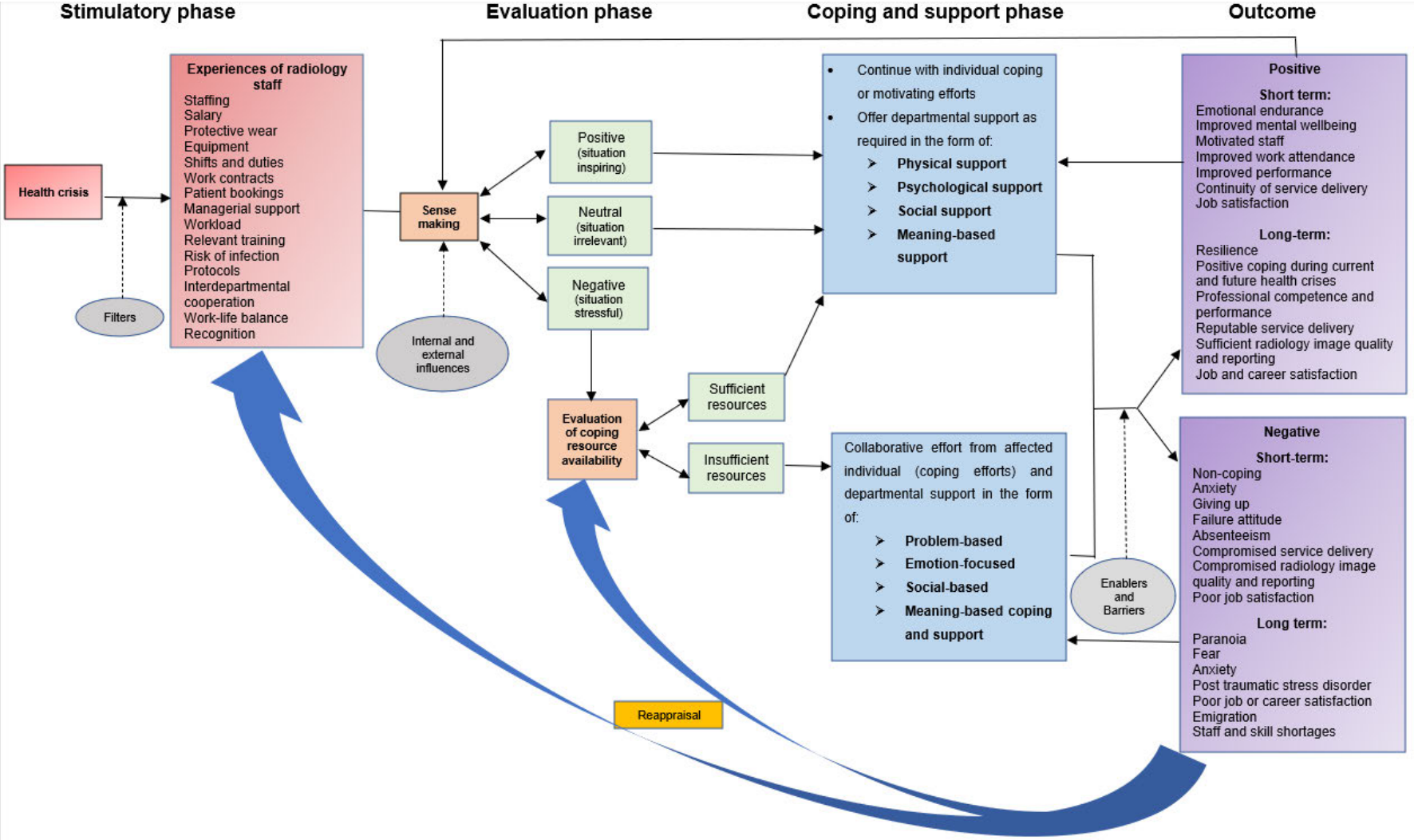

Figure 7.3: The frontline radiology staff mental health support framework

The proposed framework's concepts and their interconnections (Figure 7.3) are discussed in the following sections, structured according to the framework's identified phases: the stimulatory phase, evaluation phase, coping and support phase, and the outcome and reappraisal phase.

7.3.1 Stimulatory phase

During the stimulatory phase, radiology staff encounter the health crisis and experience it in various ways, potentially influenced by the filters as discussed in the subsequent subsections.

7.3.1.1 Health crisis

Chinengundu, Chakamba and Hondonga (2022: 16) defined health crises as difficult, complex and sudden health emergencies affecting one or more geographic locations. Hence, their unpredictable nature makes it difficult to pre-plan for them and their related consequences. Under the current context, such health crises could be pandemics, epidemics or any outbreaks within a geographical location that will present an acute challenging situation within the radiology departments. In keeping with Biggs, Brough and Drummond (2017), these health crises present as potential stress stimuli as they can possibly influence the experiences of the frontline radiology staff during a health crisis. Therefore, together with the experiences of the frontline radiology staff, they make up the stimulatory phase.

7.3.1.2 Filters

Represented as a dotted arrow on the framework, filters are categorised as moderating variables. They modify how the independent variable (health crisis) affects the dependent variable (experiences of radiology staff) (Hefner 2017). For the current framework, these filters include personal (internal) factors such as demographics and resilience capabilities. They also include work-related (external) factors such as staffing, working conditions, availability of required resources, and support. These factors can potentially influence how radiology

staff experience working during a health crisis within their designated radiology departments. As part of ongoing staff wellness programmes, pre-identification of the work-related filters by management could aid them in forecasting predictors of occupational stress among their frontline radiology staff before a crisis strikes. Additionally, these factors would significantly contribute to how the framework can be implemented. This applies to radiology departments with varying circumstances during the health crisis.

7.3.1.3 Experiences of radiology staff

Frontline radiology staff in different geographical locations and healthcare settings will likely have different experiences and challenges, despite facing the same health crisis. These differences depend on how they perceive the stress stimuli (health crisis). Personal and work-related attributes that filter their perceptions also play a role (Lazarus and Folkman 1984; Krueger 2007; Palmieri and Peterson 2009).

Based on the current research findings, the frontline radiology staff's experiences during health crises likely include both physical and mental challenges. The physical experiences may involve staff shortages, a lack of protective wear, reduced income, non-renewal of contracts, insufficient training, increased workload, and poor work-life balance. The mental experiences may include feelings of non-recognition, anxiety, fear, paranoia, mental exhaustion, stress, and a lack of managerial support.

In keeping with Dewey's theory of experience (Cunningham 2014), awareness of frontline radiology staff's previous experiences can be used as a planning tool. This can help equip the radiology department for unforeseen crises like COVID-19. While health crises may differ from one another, forecasting and the availability of phenomenological experiences can aid the department. This will help provide a structured guide for practice, management, and coping during any health crisis. The plan should include ensuring that recommended health and safety protocols are in place. It should also involve having adequate

departmental IPC representation at the institutional level and ongoing IPC training for staff as part of CPD to encourage attendance.

7.3.2 Evaluation phase

The evaluation phase involves sense-making and evaluating the availability of coping resources, as outlined below.

7.3.2.1 Sensemaking

Sensemaking, as defined by Weick, Sutcliffe, and Obstfeld (2005), is the ongoing, retrospective process of constructing plausible interpretations that rationalise actions and experiences. Within the context of this study, sensemaking plays a critical role in enabling frontline radiology staff to process and navigate the challenges posed by a health crisis. Referred to as 'primary appraisal' by Lazarus and Folkman (1984), it involves assessing the significance of a situation and its potential impact on their well-being and professional responsibilities. This cognitive process allows radiology staff to assign meaning to their experiences during the health crisis.

Radiology staff may face similar challenges or experiences during a health crisis. However, their perception of these experiences and the consequences they face can vary. This perception influences whether they see the situation as positive (encouraging and inspiring), neutral (irrelevant and having no impact), or negative (stressful and affecting their mental health) (Biggs, Brough, and Drummond 2017). This aligns with Lazarus and Folkman (1984), who described these as personal and situational characteristics influencing appraisal. The frontline radiology staff's perceptions will vary based on several subjective (internal) influences. These include previous experience of working during a health crisis, level of IPC training and competency, resilience, perceived susceptibility to infection, and perceived severity of the outcomes of these experiences (Carpenter 2010). External influences, such as colleagues with negative perceptions who may impact other radiology staff (peer influence), can also play a role (Krueger 2007; Palmieri and Peterson 2009).

According to the proposed framework (Figure 7.3), sensemaking and the evaluation of coping resource availability constitute the evaluation phase. During this phase, the department and individual frontline radiology staff assess their mental well-being and the availability of necessary resources. Sensemaking and its outputs (positive, neutral, or negative) share a bi-directional interaction. This is because frontline radiology staff may mentally revisit this stage to ensure they have accurately interpreted their perceived meaning of the situation. Similarly, both frontline radiology staff and radiology departments evaluate the availability of coping resources. They may revisit the process to confirm the evaluation outcome. Thereby establishing a bi-directional relationship between the evaluation of coping resource availability and its sufficiency outcome.

7.3.2.2 Evaluation of coping resource availability

The impact of the radiology staff's experiences on their mental health would vary depending on what they encountered and how they perceived those events. Negative experiences would likely affect their mental well-being (Biggs, Brough, and Drummond, 2017), potentially leading to emotional exhaustion, strain, anxiety, fear, and paranoia. Consistent with Lazarus and Folkman (1984) and Carpenter (2010), the staff's perceived susceptibility and the level of threat to their well-being and loved ones significantly influenced their emotional and mental responses to the crises. Following the negative outcome of the sensemaking process, both the department and the radiology staff engage in evaluating the availability of coping resources. Lazarus and Folkman (1984) refer to this process as 'secondary appraisal.' The results of this evaluative process determine whether coping resources are deemed sufficient or insufficient, which in turn directs the transition into the coping and support phase.

7.3.3 Coping and support phase

Following the impact of the negative experiences on frontline radiology staff's mental health and possibly professional competency, the staff will, by default,

consciously or subconsciously adopt a coping strategy. They will be supported by the department through the process. As indicated by Lazarus and Folkman (1984), individuals are more likely to use strategies they are most familiar with, feel most comfortable using, and perceive as most beneficial. Therefore, as per the current research findings and existing literature and theories, the frontline radiology staff would benefit hugely from various coping styles categorised as emotion-focused coping, problem-based coping, social-based coping and meaning-based coping (Lazarus and Folkman 1984; Folkman 2008; Kim and McKenzie 2014).

Considering the perceptions on coping strategies, the availability of several coping styles would create options for the frontline radiology staff and the department to choose from. As a result, this will increase the chances of likely finding the most suitable option for themselves and their present settings. As the line management, the department of radiology will support staff in various ways as indicated in the subsequent sections. The coping styles are elaborated further as follows:

7.3.3.1 Problem-based coping

Problem-based coping strategies aim to get to the bottom of the challenge and address the stress stimuli or other factors causing stress. In accordance with Lazarus and Folkman (1984), *'taking control, information seeking and evaluating the pros and cons'* can be adapted as problem-based strategies within radiology departments. Solution-oriented strategies would come handy at both departmental and personal levels as they attempt to modify or eliminate the stressor (Lazarus and Folkman 1984).

Considering that health crises can be unpredictable and complex, staff and management within radiology departments would aim to address the health crisis consequences that are within their reach. These may include individual frontline radiology staff adopting various problem-solving techniques. They might engage collaboratively with management to discuss ways of addressing

the challenges they face. They could also reach out to departmental management for additional support.

Improving time management and prioritisation while performing their duties is another important strategy. Attending available training sessions that support their roles can also be beneficial. Additionally, staff can equip themselves with more knowledge by reading about the health crisis, IPC, and other problem-based coping strategies available in the literature.

Collaborative efforts between staff and management would allow for a better and potentially long-lasting outcome. Hence, it is advisable for departmental management to engage with the staff to establish how best they can support the team during the health crisis. As part of support with problem-based coping, management could employ more staff to address staff shortages. Depending on the circumstances, the extra staff can be recruited on a temporary or short-term contract to relieve the added workload on the staff. Purchasing, repairing and maintaining equipment by management will likely make the staff's work easier.

This can be coupled with the improvement of working conditions by the employer or the radiology department. Provision of adequate IPC gear, training and work hours aligned with the employment regulations to ensure staff have a healthy work-life balance would also be necessary. Staff facing salary cuts should be supported financially wherever possible. At a minimum, they should be informed in advance about the department's financial challenges and what to expect. They would need to work only the hours that align with their reduced salary. During the remaining time, they should be allowed to take on part-time work. This would help them continue to support their families.

Additionally, in alignment with Kim and McKenzie's (2014) findings, radiology departments could support employee awareness efforts. They could encourage staff to engage in any form of physical exercise. Departments should also make

provision for such engagement. This could help address some of the health crisis consequences that may be affecting staff's mental health.

7.3.3.2 Emotion-focused coping

Considering that health crises and their consequences may be beyond the control of radiology staff and management, emotion-focused strategies can be adopted during an ongoing health crisis. These strategies aim to enhance radiology staff's responses to stress stimuli, fostering both resilience and coping (Lazarus and Folkman 1984; Cooper *et al.* 2006). Based on the current research findings and Cooper *et al.* (2006), positive emotion-focused coping strategies that radiology departments could implement include providing emotional support through psychological counselling services for frontline radiology staff via the staff clinic. Management would also need to allocate time for affected staff to attend these counselling sessions while ensuring privacy and space for them to vent. During these sessions, radiology staff could be guided to adopt acceptance of the situation (health crisis and its consequences) and their professional responsibilities as an additional emotion-focused strategy. Furthermore, recognition and appreciation of staff efforts and hard work by management would be invaluable in cementing these strategies.

7.3.3.3 Social-based coping

The American Psychological Association (APA) (2023) refered to social-based coping as social support. It defines this type of coping as a provision of emotional, social and material assistance to help cope with stressors. In light of this, radiology departments could adopt social-based coping by fostering strong motivation and support from management, as well as encouraging similar support among team members.

As evidenced by the current research findings, radiology staff valued support and motivation from their departmental and institutional management. This coping strategy can be implemented through a continued two-way relationship between management and staff. It benefits both the staff and the continuation

of high-standard service delivery. The type of support offered can include psychological support, such as emotional motivation and empathy. It can also include material support, like salary or payment arrangements that consider both staff and management's positions. Social support can be provided by promoting and allowing time for support groups and work-life balance. Additionally, staff could create peer support networks through platforms such as WhatsApp or in person, provided these align with any IPC protocols in place.

7.3.3.4 Meaning-based coping

Described as *'appraisal-based coping in which the person draws on their beliefs, values and existential goals to motivate and sustain coping and wellbeing during a difficult time'* (Folkman 2008), radiology departments could implement meaning-based coping at both departmental and personal levels. Depending on staff members' individual backgrounds, these efforts could include spiritual therapy on a personal basis or the provision of meditation and prayer facilities within institutions during staff break times. Reappraising aspirations to align with changed circumstances (such as a health crisis) and reordering priorities at both departmental and personal levels could also serve as beneficial coping techniques (Folkman 2008).

Additionally, as part of supporting radiology staff, management could focus on fostering positive emotions among staff by reminding them of the benefits their radiology services provide to the community during a health crisis. This could help motivate staff by reinforcing the value of their contribution. It will encourage staff to recognise the good they are doing by continuing to deliver essential services, even in such a challenging and unpredictable time.

7.3.3.5 Continued departmental support

Regardless of the outcomes of the sensemaking process or the evaluation of coping resource availability, staff who perceive the situation as positive (inspiring) or neutral (irrelevant), as well as those who find their coping resources sufficient, should receive ongoing departmental support as needed.

This support, provided by line management and health institutions as employers, is crucial for sustaining their resilience during the health crisis.

Additionally, line management or employers can seek external support from entities such as professional registration authorities (e.g., HPCSA and SANC). These organisations may provide resources such as reading materials, crisis-related information, daily updates, and advice on coping strategies to assist staff with various challenges. Support may also take the form of tangible interventions, including continued provision of protective equipment, training, financial assistance, and consistent updates on the health crisis and associated protocols.

Staff motivation, recognition, and appreciation of their roles in patients' healthcare journeys, along with the continued provision of spaces for venting, spiritual intervention, and psychological counselling, will ensure ongoing psychological and social support for frontline radiology staff by the radiology department and employer. Depending on IPC restrictions, accessible places of worship could also be made available to staff as part of meaning-based support.

7.3.3.6 Barriers to coping

To ensure the framework's implementation is beneficial and evidence-based, it is imperative to forecast, identify, and address any potential barriers to frontline radiology staff's coping strategies. This aligns with the Health Belief Model (HBM), which has been influential in developing various health-related interventions (Glanz and Bishop 2010; Glanz, Rimer and Viswanath 2015).

Based on the current research findings, potential barriers may include work-related factors, lack of support or recognition, personal challenges, and demotivating colleagues. Identifying and addressing these barriers can occur at the departmental level through engagement between management and radiology staff, either during pre-planning stages or amidst health crises. Work-related barriers might include a lack of resources and training, insufficient managerial support, and professional non-recognition. Personal barriers, on the

other hand, can be addressed individually or with the assistance of mental health support personnel, such as a psychologist, during counselling sessions. Furthermore, social support from colleagues, family, and friends can aid in overcoming these challenges. Examples of personal barriers include lack of motivation, psychological or emotional challenges, change fatigue, a fixed mindset, personal impediments, and outside-work circumstances.

7.3.3.7 Enablers to coping

Enablers would play a crucial role in motivating individuals to implement coping strategies effectively and improve challenging situations. For this proposed framework, the suggested enablers are derived from the participants' narratives. This ensures their relevance and feasibility for the study population. Motivation and support from both management and team members are critical enablers, as organisational support is widely recognised as fostering positive work environments, enhancing staff retention, and improving job performance among radiographers (Makanjee, Hartzer and Uys 2006; Ismail, Shiner and Tucker 2024). Additionally, teamwork and maintaining a healthy work-life balance were identified as significant factors in mitigating the mental health impacts of the COVID-19 pandemic. Similar findings are reported in Shahid *et al.*'s (2022) study, where teamwork positively influenced the Pakistani radiology staff's ability to cope.

Practical enablers, such as the provision of adequate PPE, addressing staff shortages, and offering financial support, can further facilitate effective coping. These measures address problem-based challenges, enabling the implementation of problem-focused coping strategies. Scholars such as Ashong *et al.* (2016) and Omidiji *et al*. (2022) have emphasised the value of prioritising work adaptations and job redesign in promoting resilience among radiology staff in Ghana and Nigeria. For example, staggered shifts allow for family support while minimising staff burnout. This strategy was similarly identified as impactful in Shahid *et al.*'s (2022) findings. Financial relief efforts from employers could further demonstrate support for their staff, which,

Makanjee, Hartzer and Uys (2006) highlighted, significantly influences staff retention.

Social interaction, accessible psychological counselling services, and spiritual support are also vital enablers. Participants cited time constraints as a barrier to accessing psychological counselling services, as they were often required to remain on duty. To address this, radiology and radiography managers should collaborate with roster managers to allocate time for staff in need of counselling support. Such measures would facilitate uptake and ensure that psychological resources are utilised effectively, contributing to the overall well-being of the workforce.

7.3.4 Outcome

Outcomes of implementing mental coping strategies and ongoing support from the radiology department or health institution can be either positive or negative. This outcome depends on the effectiveness and suitability of the strategies. It also depends on the support provided. Additionally, the management of barriers and changes associated with the stress stimuli (health crisis) plays a role. Positive outcomes would lead to improved mental well-being among radiology staff as they carry out their demanding roles during the health crisis.

Short-term positive outcomes may include emotional endurance, improved mental well-being, continuity of service delivery, and job satisfaction during the crisis. Long-term outcomes could involve resilience among staff and acquired experiences that would be invaluable for managing future health crises. Most importantly, work attendance, professional competence, service delivery, radiology image quality and reporting, and job or career satisfaction will either be improved or maintained despite the challenges posed by health crises. As a result of these short- and long-term positive outcomes, frontline radiology staff would continue to access coping options and ongoing support, either on a personal basis or as provided by the department.

On the other hand, negative outcomes that indicate an unsuccessful coping effort would require the individual or team to undergo reappraisal. This process involves identifying the stressor (experience), evaluating available coping resources, and selecting the most suitable coping style - either personally or with the help of professional or social support within the department.

Short-term negative outcomes include non-coping, anxiety, absenteeism, attitudes of giving up and failure, impacted service delivery, compromised radiology image quality and reports, and poor job satisfaction. Long-term outcomes may include PTSD, chronic anxiety, phobias, paranoia, and potential difficulties coping with future health crises or personal challenges. Additionally, radiology frontline staff experiencing poor job satisfaction may lose interest in their careers. This loss of interest could lead to changes in careers, institutions, or emigration in search of better working conditions. These changes can create staff and skill shortages.

7.3.5 Reappraisal

Both short-term and long-term negative outcomes would require the radiology staff to reassess, either consciously or subconsciously, in order to identify the actual stressors (experiences). They would also evaluate the availability and accessibility of coping resources or seek an alternative strategy that better addresses their circumstances than the previous one. Additionally, this reassessment can help adjust the current coping strategy to ensure all mental challenges are addressed. Thus, the framework cycle is an ongoing process until a positive mental-coping outcome, whether short-term or long-term, is successfully achieved.

7.4 APPLICATION OF THE FRONTLINE RADIOLOGY STAFF MENTAL HEALTH SUPPORT FRAMEWORK IN PRACTICE

Rycroft-Malone and Bucknall (2010) emphasised the importance of implementing evidence into practice at various levels, including individual,

team, and organisational. They note that this is a complex task that cannot be achieved through a one-off effort. Davies (2010) supported this argument. He highlights that evidence-based practice has long been advocated. Extensive research has been conducted to provide the necessary evidence. However, failure to implement this evidence, whether from research or simply *'doing the right thing'* undermines the goal of evidence-based practice.

The proposed framework aims to support both individuals (frontline radiology staff) in coping with mental health challenges during health crises. It also aims to support radiology departments in assisting their staff before, during, and after the crisis. This support will focus on staff wellness before the crisis, providing continuous support and reflection during the crisis, and addressing PTSD after the crisis. Both individuals and departments will play an active role at different stages, working together to ensure effective support.

Adopting the framework in the early phase helps proactively address mental health consequences related to working in specific radiology departments during a health crisis. The framework can assist management in forecasting potential stressors among staff, enabling them to take action early. As the saying goes, 'prevention is better than cure', and this proactive approach could help mitigate risks to staff well-being. Additionally, the framework could raise awareness of mental coping strategies during staff development programmes or continuing professional development (CPD).

During an ongoing health crisis, radiology departments can use the framework to address the mental health consequences among their staff. This allows management to make adjustments and ensure staff have the mental coping support they need to continue serving the community. The framework can also guide departmental discussions during a crisis, as Shahid *et al.*'s (2022) findings demonstrated that discussions boosted the morale of radiology staff. In the later stages of the crisis and post-crisis phases, the framework can be used to address any post-traumatic challenges among staff.

As part of reflective practice, both individual frontline radiology staff and the radiology departments can evaluate all phases of the framework. This reflection will contribute to learning. It will also aid the development of wellness programmes. Additionally, it supports continuous improvement. These efforts ensure that individuals are supported throughout the health crisis. They also help departments continue providing optimal support for their frontline radiology staff.

7.5 SUMMARY OF THE CHAPTER

This chapter has addressed the study's final research question (question 6) by presenting the frontline radiology staff mental health support framework. This framework was developed to address the mental health challenges faced by frontline radiology staff during health crises. The chapter outlined the framework's development process, which is based on the research findings and theoretical framework discussed earlier in the thesis. A detailed description of the framework was provided, highlighting its key components and their relevance to the well-being of frontline radiology staff during critical periods. The potential application of the framework in practice was also explored, demonstrating how it can be implemented to support staff effectively during future health crises.

CHAPTER 8: SUMMARY, CONCLUSION, STRENGTHS, LIMITATIONS AND RECOMMENDATIONS FROM THE STUDY

8.1 INTRODUCTION

To this end, the preceding seven chapters have addressed various aspects of the study, starting with the background and ending with the proposed framework. It is now essential to connect these components to provide a clear overview of the study from beginning to end. Therefore, this chapter aims to present a comprehensive summary of the study's progression, including the initial impetus, its objectives, how these objectives were achieved, and the interpretation of the findings and proposed framework designed to support frontline radiology staff during health crises. Additionally, this chapter discusses the study's strengths, limitations, and offers recommendations for practice and future research.

8.2 SUMMARY

Frontline radiology staff face an increased risk of nosocomial infection and elevated occupational stress during health crises such as the COVID-19 pandemic. These factors can significantly impact their mental health, well-being, and professional competence. Despite global recognition of the vulnerability of healthcare workers during such crises, there has been a lack of empirical research specifically exploring the mental health and well-being experiences of frontline radiology staff within the eThekwini district. This gap in the literature has limited the development of contextually relevant support strategies for this critical group of healthcare professionals.

In response, this study aimed to explore the mental health and well-being experiences of radiology staff in the eThekwini district of South Africa during a health crisis. This aim informed the formulation of the study's research questions and objectives, which are outlined below:

8.2.1.1 Main research question

What are the mental health and well-being experiences of frontline radiology staff in the eThekwini district of South Africa during the COVID-19 pandemic?

8.2.1.2 Sub-questions

1. What professional duties and roles did frontline radiology staff undertake during the COVID-19 pandemic in the eThekwini district?
2. What personal and work-related challenges did frontline radiology staff experience during the COVID-19 pandemic?
3. How do radiology staff in the eThekwini district perceive and describe their experiences of mental health and well-being during the COVID-19 pandemic?
4. How do radiology staff in the eThekwini district perceive and describe the impact of COVID-19 and its related consequences on their mental health, well-being, and professional competence?
5. What coping strategies did frontline radiology staff adopt to manage COVID-19-related mental distress?
6. What practical recommendations can be developed to support the mental health and well-being of frontline radiology staff during health crises, based on their experiences during COVID-19?

8.2.2 Research objectives

1. To explore and interpret the mental health and well-being experiences of frontline radiology staff in the eThekwini district during the COVID-19 pandemic.
2. To identify and describe the professional duties and roles assumed by frontline radiology staff during the COVID-19 pandemic.
3. To examine and categorise the personal and work-related challenges faced by frontline radiology staff during the pandemic.
4. To explore and interpret radiology staff's perceptions and narratives relating to their mental health and well-being during the COVID-19 pandemic.

5. To analyse radiology staff's perceptions of the impact of COVID-19 on their mental health, well-being, and professional competence.
6. To identify and evaluate the coping strategies employed by frontline radiology staff to manage mental distress during the COVID-19 pandemic.
7. To develop evidence-based recommendations for supporting the mental health and well-being of frontline radiology staff during future health crises.

The Modified Transactional Model of Stress and Coping (TMSC), incorporating the Health Belief Model HBM and Attribution Theory (AT), served as the theoretical framework for the study. Guided by the framework, study aim, and research questions, interview and focus group guides were developed for data collection. These semi-structured data collection sessions involved 24 participants selected through maximum variation purposive sampling. Participants included radiographers, radiologists, and nurses, working in public and private radiology departments within the eThekwini district of KZN province of South Africa.

With the use of Interpretative Phenomenological Analysis (IPA), seven themes were developed:

- Duties and roles during the COVID-19 pandemic.
- Perceived personal and work-related challenges.
- Emotional and psychological experiences when carrying out duties.
- Impact on emotional well-being.
- Impact of resultant mental health status on professional competence.
- Coping strategies.
- Intervention for mental health effects.

The outcomes of the study are elaborated further in the subsequent sections based on its sub-research questions as follows:

8.2.3.1 Frontline radiology staff's professional duties and roles during the COVID-19 pandemic in the eThekwini district.

Frontline radiology staff took on various roles that differed among professions. Across all professions, duties included infection prevention and control (IPC) obligations, patient care, and clinical tasks mostly within the HPCSA-approved scope of practice. Radiology-based nurses continued supporting patients, although COVID-19 ward nurses accompanied their patients and managed infection control. Radiographers were continuously in close contact with COVID-19 patients and persons under investigation (PUI) in the radiology department, screening units, and dedicated COVID-19 wards. They performed general x-rays and Computed Tomography (CT) scans critical to COVID-19 patient care. In addition, they handled administrative and clerical tasks such as patient registration. Radiologists justified radiology requests, liaised with referring doctors, and reported on CT scans, mammograms, and some general x-rays. Most COVID-19 chest x-rays were urgent and interpreted by referring physicians. Staff in managerial roles managed IPC training and implementation, patient bookings, and duty rosters. Due to staff shortages, they sometimes performed clinical duties.

8.2.3.2 Personal and work-related challenges experienced by frontline radiology staff during the COVID-19 pandemic.

On a personal basis, frontline radiology staff faced physical health challenges, including contracting COVID-19 and experiencing its after-effects such as fatigue, back pain and burnout due to increased workloads. Socially, the frontline radiology staff's interaction with colleagues was disrupted by social distancing policies. Furthermore, interaction with family members, particularly the elderly or those with underlying comorbidities, was severely strained as staff felt responsible for shielding vulnerable family members. Frontline radiology staff in private institutions suffered severe salary cuts and incurred financial costs for COVID-19 testing and related expenses. Within departments, frontline radiology staff reported unpreparedness, a perceived risk of infection and the need to adapt to changes in systems, protocols, and structures as significant

work-related challenges during the COVID-19 era. These challenges included shortages of PPE, staff, COVID-19-related information, managerial support, and IPC training in the early days. There was also poor sharing of COVID-19 patient information between departments.

8.2.3.3 Frontline radiology staff's perceived mental health and well-being experiences during the COVID-19 pandemic

The frontline radiology staff indicated fear as the most significant experience when conducting their duties during the COVID-19 health crisis. Such fear included anxiety about the unknown disease, COVID-19 and fear of contracting it. Frontline radiology staff feared the unknown disease as information was scarce and rapidly dynamic during the early phases. Together with the perceived risk of infection within departments, anxiety, stress and paranoia of attending to COVID-19 patients, and increased mortality in the hospitals, frontline radiology staff feared contracting the virus as they went on with their duties.

8.2.3.4 Perceived influences of COVID-19 and its related consequences on the frontline radiology staff's mental well-being

The frontline radiology staff's experiences of COVID-19 and its related consequences significantly impacted their mental well-being. These impacts presented as emotional strain and mental health challenges. Frontline radiology staff experienced emotional exhaustion and heightened fear due to colleagues contracting COVID-19. They also faced non-recognition of their professions by fellow healthcare professionals from other departments. Additionally, frontline radiology staff developed paranoia and other mental effects, mostly when attending to COVID-19 patients.

8.2.3.5 Perceived influence of the resultant mental health status of frontline radiology staff on their professional competence during the pandemic era

As a result of the mental health burden emanating from the frontline radiology staff's experiences with COVID-19 and its related consequences, attendance was severely impacted. These challenges led to absenteeism and the shirking of work responsibilities and duties. Patient care and interaction were strained due to intentionally and unintentionally reduced patient interaction, contact time and communication during the imaging of COVID-19 patients and PUIs. Additionally, the frontline radiology staff's exhaustion reduced their urge to adhere to IPC protocols.

8.2.3.6 Coping strategies adopted by frontline radiology staff to manage COVID-19-related mental distress

Literature suggests diverse mental-coping strategies, although they are mostly either generic or focused on patients. Therefore, they are not specifically directed at frontline radiology staff. These strategies include problem-focused, emotion-focused, social-based, and meaning-based coping. The frontline radiology staff identified emotion-focused and problem-focused coping as their most preferred strategies for managing COVID-19-related mental distress.

Emotion-focused coping strategies included accepting professional responsibilities and duties, social coping, appraisal-focused coping, not taking action, spiritual therapy, and psychological counselling. However, none of the frontline radiology staff reported personally utilising counselling services offered within their institutions. Problem-focused coping strategies adopted by frontline radiology staff included adaptive behavioural coping, occupation-focused coping or escape-avoidance, exercise, and solution-oriented approaches. Despite these coping efforts, frontline radiology staff faced barriers such as work-related challenges, lack of support from management, non-recognition, personal factors, and demotivating colleagues.

8.2.3.7 Framework to support the mental health and well-being of frontline radiology staff during health crises

Following the highlight of the mental health impact of COVID-19 and its related consequences on frontline radiology staff, as well as its influence on their professional competence, a mental health-coping framework was proposed. The developed framework is designed for use during pre-planning sessions, ongoing health crises, and post-crisis periods to address post-traumatic stress disorder (PTSD). The framework was constructed based on the study's findings, literature, and established theoretical framework, then validated by experts in the field. The proposed framework could be adopted by relevant departments to improve staff mental wellness and coping abilities during health crises. Resultantly, service delivery standards will be maintained.

8.3 STRENGTHS OF THE STUDY

The study demonstrated several strengths, including the selection of a methodology (Interpretative Phenomenological Analysis) that captured the unique voice of each participant. This methodological approach allowed participants to share and make sense of their experiences of the COVID-19 pandemic while working in either private or public radiology departments in the eThekwini district. By using IPA, the study was able to address its aim, research questions and objectives in detail.

Following van de Venter *et al*. (2021)'s survey, significantly high coronavirus anxiety scale scores were reported. These scores indicated probable dysfunctional anxiety among South African radiographers. The current study explored potential causes of these elevated scores among radiographers in radiology departments within the eThekwini district during the COVID-19 pandemic.

The qualitative nature of the study, which implied no closed-ended responses, allowed the participants to share their unique experiences. They were not bound by the need to align with the provided options, as occurs in quantitative

studies (Chetty 2016). This enabled the participants to explain themselves to a heightened extent. As evidenced by the collected data, some participants were grateful for the opportunity to take part in the study as they felt that it provided a platform for them to vent. Moreover, participants felt the study also presented an opportunity for them to be heard and recognised, as most studies conducted during the COVID-19 pandemic had mostly focused on patients, nurses, and doctors.

In addition to the mentioned strengths, the chosen interview-focus group hybrid data collection strategy allowed for the validation of ideas (Bauer and Gaskell 2000). It also enabled the evaluation of differences in opinions when participants were interviewed separately and as a group (Halcomb *et al.* 2007). The focus groups allowed participants to feel free to share and voice sensitive work-related issues without fear of victimisation (Bauer and Gaskell 2000).

Considering that qualitative studies involve the continued engagement of the researcher with the entire research process, they tend to suffer from researcher bias. To address this, the study adopted all four dimensions of the Trustworthiness framework by Guba and Lincoln (1994) (Johnson and Christensen 2014): credibility, dependability, confirmability, and transferability. Adoption of these strategies early in the study ensured the rigour and trustworthiness of the outcomes. This included, among many other adopted techniques, reflexivity journaling, bracketing and investigator triangulation.

Lastly, the developed mental health-coping framework tailored to the radiology department was constructed based on the research findings and literature. It also drew from reputable models and theory (TMSC, HBM and AT), which have been adopted in several fields. Therefore, as emphasised by Baker and Young (2016) and Walker and Avant (2011), the developed mental health coping framework adds to the radiology department's body of knowledge. It provides a knowledge base for the establishment of employee awareness and mental coping programmes within radiology departments.

8.4 LIMITATIONS OF THE STUDY

Described by Ross and Zaidi (2019) as representations of the research's characteristics that impact or influence the study's findings and conclusions, limitations are common in research. They ought to be discussed to validate the findings and prevent similar limitations in future related research. In line with this expectation, the qualitative nature of the current study prevented the generalisation of the findings. However, although generalisation to a broader population is important, the chosen methodology allowed the phenomenological nature of the research questions to be adequately addressed.

Due to the nature of qualitative research, which involves smaller sample sizes, anonymity and confidentiality responsibilities presented challenges when reporting sensitive findings. To address these concerns, the section was rewritten. Conformability was ensured through confirmation from co-researchers or supervisors. This revision process was adopted for the current study as recommended for qualitative reporting (Forero *et al*. 2018).

Notwithstanding the benefits of using a hybrid interview–focus group data collection method, the process of data analysis proved time-consuming. The researcher had to engage deeply with the large volume of data. To manage this demand, the researcher followed time management and discipline strategies recommended by expert qualitative researchers. These practices helped develop patience and enjoyment of the process while preventing burnout. Additionally, investigator triangulation ensured that the time-consuming nature of the analysis did not interfere with the quality of the findings.

Bringing together participants for focus group discussions (FGDs) was a challenge as participants worked different shifts and therefore preferred conflicting times. Moreover, conducting the study during the peak of the pandemic made it difficult to approach participants easily due to IPC protocols in place in most radiology departments. To overcome this barrier, various

modes of communication were used, such as emails and requesting time slots during departmental meetings to present the study to staff.

Acknowledging potential bias is crucial to ensuring the validity of research findings (Simundic 2013). As discussed in chapter four, the researcher recognises the possibility of volunteer bias, particularly across professional and sector categories. To mitigate this bias, efforts were made to ensure broad awareness of the study among staff. The study's aim was clearly communicated, and flexible interview or focus group timeframes were offered. This strategy aimed to accommodate participants' schedules and encourage widespread participation. Additionally, participants were assured of anonymity and confidentiality, which the researcher maintained throughout the study.

Researcher bias, including confirmation bias, is a common concern in qualitative research (Smith and Noble 2014). While the semi-structured nature of the data collection process could introduce some restrictions, it was purposefully designed to align with the study's aim, research questions and objectives. At the same time, it allowed participants the flexibility to elaborate on areas they deemed significant. This approach balanced structure with openness, ensuring high data quality.

To further address potential bias, bracketing was employed. The researcher reflected on personal assumptions and background throughout the study. These reflections were documented in chapters one, four and six, demonstrating a critical and transparent approach to the research process.

8.5 RECOMMENDATIONS

Following the findings and conclusions of the study, the resultant recommendations are presented as follows:

8.5.1 Recommendations for practice

The current study has evidenced that COVID-19 and its related consequences impacted the mental health of frontline radiology staff. As a result, the findings have brought to light the need to pay more attention to occupational stress, which tends to be exacerbated during health crises. In line with these findings, the adoption of the developed frontline radiology staff mental health support framework by relevant departments during health crises is highly recommended. The framework aims to improve staff mental wellness and coping abilities during health crises, thereby helping to maintain the standards of radiological images, diagnosis, and patient care.

As part of staff development programmes, it is recommended to incorporate mental health, coping, and resilience as key awareness topics. Implementation may involve dedicating a brief section of departmental meetings to share new information with staff or discuss related issues. Furthermore, continued mental and physical health support for staff despite COVID-19 not being a global emergency is highly recommended, given the documented long-term physical and mental health effects of the virus (Panchal *et al.* 2023).

Based on the findings, developmental courses for line managers focused on supporting and motivating staff (staff management skills) would be beneficial. Frontline radiology staff considered managerial support as a much-needed booster during the crisis. Considering that some managers within radiology departments are promoted to managerial positions based on profession-specific qualifications, years of experience, or employment equity targets (DPSA 2023), it is important to address any existing gaps in staff management and support practices. Doing so would benefit both the radiology staff and patients. Liaising with local higher education providers may offer a valuable platform for establishing short courses tailored to developing management competencies in this area.

To address the chronic issue of the non-recognition of frontline radiology staff, specifically radiographers, health institutions could facilitate and promote professional awareness activities that include CPD benefits. Such initiatives may create opportunities for staff to explore how other professions and departments contribute to the patient's healthcare journey.

As part of the radiology department's teaching and training responsibilities, periodic sessions could be held with referring departments. These sessions would focus on educating staff about properly completing radiology requests, sharing appropriate patient information, and adhering to institutional radiology protocols.

8.5.2 Recommendations for future research

Research studies testing the developed mental health-coping framework during pre-, middle-, and post-phases of a health crisis are recommended. An initial focus could involve studies on frontline radiology staff suffering from PTSD following their experiences during the COVID-19 pandemic and its related consequences. Based on participants' comments from the Delphi survey evaluating the framework, it is also recommended that research be conducted to test the framework's application during normal operational periods, outside of health crises. (Chinene 2023) indicated that occupational stress occurs during these regular times and is aggravated during health crises. Post-COVID-19 follow-up surveys involving frontline radiology staff in the eThekwini district are also recommended. These follow-up studies would seek to explore the long-term impact of the pandemic on how staff conduct their duties moving forward. Such research would make a valuable contribution to the radiography body of knowledge.

Based on the findings of the current study and supporting literature, both local and global quantitative studies are highly recommended to examine the extent of non-recognition among radiology staff, specifically radiographers. Following that, an exploration of the solutions or measures to address the non-recognition

of radiographers would be a valuable addition to radiography research and practice.

8.6 SUMMARY OF THE CHAPTER

This chapter has presented a comprehensive summary of the study's exploration into the mental health and well-being experiences of frontline radiology staff during the COVID-19 pandemic in the eThekwini district of South Africa. It also outlined the development of a mental health support framework for frontline radiology staff, based on the study's findings and theoretical framework. In addition, the chapter discussed the study's conclusions, strengths, limitations, and recommendations for practice and future research. By integrating the key elements from the preceding seven chapters, the final chapter has emphasised the study's contribution to enhancing knowledge and providing practical strategies to support the mental health and well-being of frontline radiology staff during health crises.

REFERENCES

Abbas, M., Omer, A. and Hamad, M. 2016. Adequacy of clinical information on radiology request cards from medical assessment unit. Clinical Audit. *Nuclear Medicine and Biomedical Imaging,* 1(1): 5-6. (Online). Available: https://www.oatext.com/Adequacy-of-clinical-information-on-radiology-request-cards-from-medical-assessment-unit-Clinical-Audit.php#Article (Accessed 12 February 2023).

Abdullah, N.A.C., Supar, R., Sharip, H. and Ammani, Y.M. 2023. Occupational Stress and coping Strategies among Radiographers. *Environment-behaviour proceedings journal*, 8(25): 247–253. (Online). Available: https://doi.org/10.21834/e-bpj.v8i25.4870 (Accessed 27 September 2024).

Abend, G. 2008. The- Meaning of 'Theory'. *Sociological Theory*, 26(2): 101-200. (Online). Available: https://journals.sagepub.com/doi/epdf/10.1111/j.1467-9558.2008.00324.x (Accessed 14 January 2023).

Ahmat, A., Okoroafor, S.C. and Kazanga, I. 2022. The health workforce status in the WHO African Region: findings of a cross-sectional study. *BMJ Global Health* 7: e008317. (Online). Available: https://gh.bmj.com/content/7/Suppl_1/e008317.info (Accessed 15 June 2023).

Akinola, R., Akinkunmi, M., Wright, K. and Orogbemi, O. 2009. Radiology request forms: are they adequately filled by clinicians? *The Internet Journal of Radiology*, 12(1): 1-5. (Online). Available: https://ispub.com/IJRA/12/1/6684 (Accessed 15 February 2023).

Akudjedu, T.N., Botwe, B.O., Wuni, A.-R. and Mishio, N.A. 2020. Impact of the COVID-19 pandemic on clinical radiography practice in low resource settings: The Ghanaian radiographers' perspective. *Radiography*, 27(2): 443-452. (Online). Available: https://doi.org/10.1016/j.radi.2020.10.013 (Accessed 21 December 2024).

Akudjedu, T.N., Lawal, O., Sharma, M., Elliott, J., Stewart, S., Gilleece, T., McFadden, S. and Franklin, J.M. 2020. Impact of the COVID-19 pandemic on radiography practice: findings from a UK radiography workforce survey. *BJR Open*, 2(1): 1-11. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33178980/ (Accessed 23 June 2021).

Akudjedu, T.N., Mishio, N.A., Elshami, W., Culp, M.P., Lawal, O., Botwe, B.O., Wuni, A.R., Julka-Anderson, N., Shanahan, M., Totman, J.J. and Franklin, J.M. 2021. The global impact of the COVID-19 pandemic on clinical radiography practice: A systematic literature review and recommendations for future services planning. *Radiography*, 27(4): 1219-1226. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/34303601/ (Accessed 23 November 2022).

Akyurt, N. 2021. Knowledge, practice and emotional status related to COVID-19 pandemic among radiology technicians working at pandemic hospitals. *Eur J Radiol*, 134(109431): 1-9. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33259991/ (Accessed 23 May 2022).

Alahmari, A. 2021. Reporting Radiographers: Hope or Hype. *Austin Journal of Radiology*, 8(3): 1-4. (Online). Available: https://austinpublishinggroup.com/radiology/fulltext/ajr-v8-id1130.pdf (Accessed 15 March 2023).

American Institute of Stress (AIS). 2022. *Workplace stress.* (Online). Available: https://www.stress.org/workplace-stress (Accessed 28 December 2022).

American Psychological Association. 2023. *APA Dictionary of Psychology.* (Online). Available: https://dictionary.apa.org/social-support (Accessed 02 August 2023).

Asenahabi, B.M. 2019. Basics of Research Design: A Guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, 6(5): 76-89. (Online). Available: http://ijcar.net/assets/pdf/Vol6-

No5-May2019/07.-Basics-of-Research-Design-A-Guide-to-selecting-appropriate-research-design.pdf (Accessed 23 February 2021).

Ashley-Roberts, C. 2023. *Your Time to Grow.* (Online). Available: https://yourtimetogrow.com/feel-confident-in-your-new-job/#:~:text=With%20a%20new%20job%2C%20there's,feel%20confident%20in%20your%20role (Accessed 15 June 2023).

Ashong, G.G.N.A., Rogers, H., Botwe, B.O. and Anim-Sampong, S. 2016. Effects of occupational stress and coping mechanisms adopted by radiographers in Ghana. *Radiography*, 22(2): 112–117. (Online). Available: https://doi.org/10.1016/j.radi.2015.09.002 (Accessed 27 September 2024).

Baker, F.A. and Young, L. 2016. The relationship between research and practice In: *Psychology*. (Online). Available: https://spectrum.library.concordia.ca/id/eprint/981359/1/Research%20Practice%20chapter.pdf (Accessed 15 July 2023).

Bauer, M.W. and Gaskell, G. eds. 2000. *Qualitative researching with text, image and sound: A Practical Handbook*. London: SAGE. (Online). Available: https://www.researchgate.net/publication/30527369_Qualitative_Researching_with_Text_Image_and_Sound_A_Practical_Handbook_for_Social_Research (Accessed 10 June 2020).

Krueger, J.I. 2007. Attribution Theory In: *Encyclopaedia of Social Psychology*. Baumeister, R.F and Vohs, K.D. eds. California: SAGE Publications. (Online). Available: http://sk.sagepub.com/reference/socialpsychology (Accessed 20 May 2020).

Bell-Martin, R.V. and Marston, J.F. 2019. Confronting Selection Bias: The Normative and Empirical Risks of Data Collection in Violent Contexts. *Geopolitics*, 26(1): 159–192. (Online). Available: https://doi.org/10.1080/14650045.2019.1659780 (Accessed 25 January 2025).

Bergen, N. and Labonté, R. 2020. Everything Is perfect, and We Have No problems: Detecting and Limiting Social Desirability Bias in Qualitative Research. *Qualitative Health Research*, 30(5): 783-792. (Online). Available: https://doi.org/10.1177/1049732319889354 (Accessed 21 December 2024).

Bhvita, J. and Cooke, G. 2022. *Fixed Digital Radiography and Fluoroscopy See Market Growth* (Online). Available: https://www.itnonline.com/article/fixed-digital-radiography-and-fluoroscopy-see-market-growth (Accessed 14 June 2023).

Biggs, A., Brough, P. and Drummond, S. 2017. Lazarus and Folkman's Psychological Stress and Coping Theory. In: *The Handbook of Stress and Health: A Guide to Research and Practice* (online). West Sussex: John Wiley & Sons Ltd. (Online). Available: https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781118993811 (Accessed 09 July 2020).

Birman, D.H. 2023. Investigation of the Effects of Covid-19 on Different Organs of the Body. *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 2(1): 24-36. (Online). Available: https://doi.org/10.5281/zenodo.7353407 (Accessed 24 February 2023).

Bridger, R.S., Morton, K. and Day, A.J. 2013. Occupational stress and employee turnover. *Ergonomics*, 15(11): 1629-39. (Online). Available: https://doi.org/10.1080/00140139.2013.836251 (Accessed 12 January 2023).

Britton, S., Lawrence, T. and Pieterse, H. 2017. The lived experiences of radiographers in Gauteng. *The South African Radiographer*, 55(1): 28-32. (Online). Available: https://sar.org.za/index.php/sar/article/view/379 (Accessed 15 March 2023).

Bhui, K., Dinos, S., Galant-Miecznikowska, M., de Jongh, B. and Stansfeld. 2016. Perceptions of work stress causes and effective interventions in employees working in public, private and non-governmental organizations: a qualitative study. *BJPsych Bulletin*, 40(6): 318-325. (Online). Available: https://doi.org/10.1192/pb.bp.115.050823 (Accessed 23 February 2023).

Boughner, R. 2010. Volunteer Bias. In: *Encyclopedia of Research Design*. Thousand Oaks, CA: SAGE Publications. Available: https://doi.org/10.4135/9781412961288 (Accessed 21 December 2024).

Brocki, J.M. and Wearden, A.J. 2006. A critical evaluation of the use of interpretative phenomenological analysis (IPA) in health psychology. *Psychology and Health*, 21(1): 87-108. (Online). Available: https://doi.org/10.1080/14768320500230185 (Accessed 23 February 2023).

Brymer, E., Schweitzer, R. 2013. Extreme sports are good for your health: a phenomenological understanding of fear and anxiety in extreme sport. *J Health Psychol*, 18(4): 477-87. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/22689592/ (Accessed 20 June 2023).

Bwanga, O., Kayembe, R.M. and Sichone, J.M. 2022. Intravenous cannulation and administration of contrast media by radiographers: a literature review to guide the training and practice in Zambia. *African Health Sciences*, 22(2): 629-637. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9652686/#:~:text=The%20role%20of%20radiographers%20performing,Australia%2017%20and%20Ireland%2020 (Accessed 13 March 2023).

Cambridge Advanced Learner's Dictionary and Thesaurus. 2023. *Evidence-based.* (Online). Available: https://dictionary.cambridge.org/dictionary/english/evidence-based- (Accessed 02 August 2023).

Cambridge Dictionary. 2020. *DECENTRALIZE | meaning in the Cambridge English Dictionary*. (Online). Available: https://dictionary.cambridge.org/dictionary/english/decentralize (Accessed 15 January 2025).

Cambridge Dictionary. 2023. PhD. (Online). Available: https://dictionary.cambridge.org/dictionary/english/phd. (Accessed 26 June 2025).

Cambridge University Press and Assessment (CUPA). 2023. *Presumption*. (Online). Available: https://dictionary.cambridge.org/dictionary/learner-english/presumption (Accessed 24 July 2023).

Carpenter, C.J. 2010. A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication*, 25(8): 661–669. (Online). Available: https://doi.org/10.1080/10410236.2010.521906 (Accessed 25 July 2020).

Cavallo, J.J. and Forman, H.P. 2020. The economic impact of the COVID-19 Pandemic on Radiology Practices. *Radiology*. (Online). Available: http://pubs.rsna.org/doi/10.1148/radiol.2020201495&ved (Accessed 10 May 2020).

Centres for Disease Control and Prevention (CDC). 2020. *Social distancing: keep a safe distance to slow the spread.* (Online). Available at: https://stacks.cdc.gov/view/cdc/90522. (Accessed 23 September 2024).

Centres for Disease Control and Prevention (CDC). 2023a. *How to Protect Yourself and Others.* (Online). Available: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html (Accessed 23 April 2023).

Centres for Disease Control and Prevention (CDC). 2023b. *Underlying Medical Conditions.* (Online). Available: https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html (Accessed 23 April 2023).

Chan, A.O.M and Huak, C.Y. 2004. Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore, *Occupational Medicine*, 54(3): 190-196. (Online). Available: https://doi.org/10.1093/occmed/kqh027 (Accessed 19 March 2021).

Chandler, D. and Munday, R. 2011. *A Dictionary of Media and Communication: Lived Experience.* New York: Oxford University Press. (Online). Available: https://www.oxfordreference.com/display/10.1093/acref/9780199568758.001.0001/acref-9780199568758 (Accessed 02 August 2023).

Cleary, N., McNulty, J.P., Foley, S.J. and Kelly, E. 2017. An investigation into current protocols and radiographer opinions on contrast extravasation in Irish CT departments. *Radiography*. 23(4): E87-E92. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/28965909/ (Accessed 23 June 2023).

Chemical Safety Facts. 2022. *Personal Protective Equipment and Chemistry*. (Online). Available: https://www.chemicalsafetyfacts.org/health-and-safety/personal-protective-equipment-and-chemistry/ (Accessed 23 February 2023).

Cheon, B.K., Kim, C.L., Kim, K.R., Kang, M.H., Lim, J.A., Woo, N.S., Rhee, K.Y. and Kim, H.K. 2018. Radiation safety: a focus on lead aprons and thyroid shields in interventional pain management. *The Korean Journal of Pain*, 31(4): 244-252. (Online). Available: https://www.epain.org/journal/PubReader.html?volume=31&number=4&spage=244#__ffn_sectitle (Accessed 23 February 2023).

Cherry, K. 2020. *A list of psychological disorders.* (Online). Available: https://www.verywellmind.com/a-list-of-psychological-disorders-2794776 (Accessed 10 May 2020).

Chetty, P. 2016. *Limitations and weakness of quantitative research methods.* (Online). Available: https://www.projectguru.in/limitations-quantitative-research/ (Accessed 22 July 2023).

Chevalier, S., Colombat, P., Lejeune, J., Guglielmin, B., Bouquet, M., Aubouin-Bonnaventure, J., Coillot, H. and Fouquereau, E. 2022. Recognition of radiographers in the workplace: Why it matters. *Radiography*, 28(3): 648-653. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/35588594/ (Accessed 15 March 2023).

Chilisa B & Kawulich BB. 2012. Selecting a research approach: paradigm, methodology and methods. In Wagner C, Kawulich B & Garner M. eds. *Doing social research. A global context*. London: McGraw-Hill.

Chima, S.C. 2011. *A primer on medical law, bioethics and human rights for African scholars.* Durban: Chimason Educational Books.

Chinene, B. 2023. Experiences of Radiographers during the COVID-19 Pandemic: A Qualitative Systematic Review, *International Journal of Medical Reviews*, 10(2): 485-496. (Online). Available: https://www.ijmedrev.com/article_174594_2f70e15a974c9792fc7ede4a3a0d4efd.pdf (Accessed 21 December 2024).

Chinengundu, T., Chakamba, J. and Hondonga, J. 2022. *COVID-19 and the Digital Transformation of Education Lessons Learnt on 4IR in Zimbabwe In Handbook of Research on Future of Work and Education: Implications for Curriculum Delivery and Work Design.* (Online). Available: https://www.igi-global.com/chapter/covid-19-and-the-digital-transformation-of-education-lessons-learnt-on-4ir-in-zimbabwe/288177 (Accessed 14 March 2023).

Chinn, P.L. and Kramer, M.K. 2004. Integrated k*nowledge development in Nursing.* 6th edition. Missouri: Mosby Inc.

Chinn, P.L. and Kramer, M.K. 2018. *Knowledge development in Nursing: Theory and process.* 10th edition. Missouri: Elsevier Inc.

Cibane, N and Hoque, M. 2024. Developing a practical framework for the recruitment and retention of radiographers in the public sector of KwaZulu-Natal Province, South Africa. *Orapuh Journal*, 5(6): e1154–e1154. (Online). Available: https://doi.org/10.4314/orapj.v5i6.54 (Accessed 21 December 2024).

Collins, C.S. and Stockton, C.M. 2018. The Central Role of Theory in Qualitative Research. *International Journal of Qualitative Methods*, 17(1): 1-10. (Online). Available: https://doi.org/10.1177/1609406918797475 (Accessed 10 July 2020).

Cooch, N. 2020. *The psychological impact of COVID-19 on physicians: Lessons from previous outbreaks. COVID-19*. (Online). Available: http://www.practiceupdate.com/content/the-psychological-impact-of-covid-19-on-physicians-lessons-from-previous-outbreaks/100995/12/24/3 (Accessed 14 May 2020).

Cooper, C.L. ed. 2005. *Handbook of stress medicine and health*. 2nd ed. Lancaster: CRC Press. (Online). Available: http://books.google.co.za/books?id=V3zLBQAAQBAJ&pg=PA88&lpg=PA88&dq=mental+coping+straegies+are+not+universal&source (Accessed 11 May 2020).

Cooper, C., Katona, C., Orrell, M. and Livingston, G. 2006. Coping strategies and anxiety in caregivers of people with Alzheimer's disease: the LASER-AD study. *J Affect Disord*, 90(1): 15-20. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/16337688/ (Accessed 23 February 2023).

Creswell, J.W. 2014. *Research design: Qualitative, quantitative, and mixed methods approaches*. 4th edition. Thousand Oaks, CA: Sage Publications.

Creswell, J.W. and Creswell, J.D. 2018. *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles: Sage Publications.

Crotty, M. 1998. *Foundations of social research: Meaning and perspective in the research process*. New South Wales: Sage Publications Ltd.

Cunningham, C.A. 2014. *Systems Theory for Pragmatic Schooling: Toward Principles of Democratic Education (The Cultural and Social Foundations of Education)*. New York: Palgrave Macmillan.

Cypress, B.S. 2017. Rigor or reliability and validity in qualitative research: perspectives, strategies, reconceptualization, and recommendations. *Dimens Crit Care Nurs*, 36(4): 253-263. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/28570380/ (Accessed 23 March 2023).

Dan, Z. 2003. How to investigate subjectivity: Natorp and Heidegger on reflection. *Continental Philosophy Review*, 36: 155-176. (Online). Available: https://doi.org/10.1023/A:1026046404456 (Accessed 23 February 2023).

Daniel, C.O. 2019. Effects of job stress on employee's performance. *International Journal of Business Management and Social Research*, 6(2): 375-382. (Online). Available: https://api.semanticscholar.org/CorpusID:210901038 (Accessed 12 April 2021).

Davies, H. 2010. Foreword In: Rycroft-Malone, J. and Bucknall, T. ed. 2010. *Models and frameworks for implementing evidence-based practice: Linking evidence to action*. Oxford: Wiley-Blackwell.

Dawood, B., Tomita, A. and Ramlall, S. 2022. 'Unheard,' 'uncared for' and 'unsupported': The mental health impact of Covid -19 on healthcare workers in KwaZulu-Natal Province, South Africa. *PLOS ONE*, 17(5): 1-17. (Online). Available: https://doi.org/10.1371/journal.pone.0266008 (Accessed 21 December 2024).

Day, S., Van Port, P. and Tay-Teo, K. 2010. *Improving participation in cancer screening programs: A review of social cognitive models, factors affecting participation, and strategies to improve participation.* (Online). Available: http://www.semanticscholar.org/paper/Improving-participation-in-Cancer-Screening-A-of-to-Day-Dort/484a069899031f205e5187684100b93e34be9f0a (Accessed 20 May 2020).

De Brier, N., Stroobants, S., Vandekerckhove, P. and De Buck, E. 2020. Factors affecting mental health of health care workers during coronavirus disease outbreaks (SARS, MERS & COVID-19): A rapid systematic review. *PLOS ONE*, 15(12): e0244052. (Online). Available: https://doi.org/10.1371/journal.pone.0244052 (Accessed 15 October 2024).

Debelu, D., Mengistu, D.A., Tolera, S.T., Aschalew, A. and Deriba, W. 2023. Occupational-Related Injuries and Associated Risk Factors Among Healthcare Workers Working in Developing Countries: A Systematic Review. *Health Services Research and Managerial Epidemiology*, 10: 1-14. (Online). Available: https://doi.org/10.1177/23333928231192834 (Accessed 15 December 2024).

Denzin, N. 2013. *The Fundamentals in an introduction to triangulation.* (Online). Available: https://www.unaids.org/sites/default/files/sub_landing/files/10_4-Intro-to-triangulation-MEF.pdf (Accessed 07 February 2023).

Department of Employment and Labour (DEL). 1993. *Health and safety in the workplace: What every worker should know about health and safety at work.* (Online). Available: https://www.labour.gov.za/DocumentCenter/Publications/Occupational%20He

alth%20and%20Safety/What%20every%20worker%20should%20know%20about%20health%20and%20safety%20at%20work.pdf?platform=hootsuite (Accessed 13 March 2023).

Department of Public Service and Administration (DPSA). 2018. *Cost of living adjustments.* (Online). Available: https://www.westerncape.gov.za/text/2019/April/2019_cost_of_living_adjustments.pdf (Accessed 23 June 2023).

Department of Public Service and Administration (DPSA). 2023. *Annexure W.* (Online). Available: https://www.dpsa.gov.za/dpsa2g/documents/vacancies/2023/05/w.pdf (Accessed 24 June 2023).

Discovery. 2020. *Discovery Health Medical Scheme extended benefits for COVID-19* (Online). Available: https://www.discovery.co.za/corporate/covid19-extended-benefits-across-health-insurance (Accessed 15 June 2023).

Ehlers, V.U., Kohler, C.F., Tefera, A., Lutge, E. and Clarke, D.L. 2021. The Burden of Emergency Abdominal Surgery Heavily Outweighs Elective Procedures in KwaZulu-Natal Province, South Africa. *J Surg Res,* 259: 414-419. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33616075/ (Accessed 23 February 2023).

Ekeh, A.P., Alleyne, R.S. and Duncan, A.O. 2000. Role of mammography in diagnosis of breast cancer in an inner-city hospital. *J Natl Med Assoc.,* 92(8): 372-4. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2608617/ (Accessed 14 March 2023).

Elshami, W., Akudjedu, T.N., Abuzaid, M., David, L.R., Tekin, H.O., Cavli, B. and Issa, B. 2021. The radiology workforce's response to the COVID-19 pandemic in the Middle East, North Africa and India, *Radiography*, 27(2): 360-

368. (Online). Available: https://doi.org/10.1016/j.radi.2020.09.016 (Accessed 12 January 2023).

European Society of Radiology (ESR). 2010. The future role of radiology in healthcare. *Insights Imaging*, 1: 2-11. (Online). Available: https://DOI.org/10.1007/s13244-009-0007-x (Accessed 23 June 2020).

Fanwang, O. 2019. *The Health Belief Model*. (wiki) (Online). Available: https://en./wiki/Health_belief_model#/media/File:%E6%96%B0%E5%BB%BA%E9%A1%B9%E7%9B%AE.jpg (Accessed 30 June 2020).

Fennessy, F.M., Mandell, J.C., Boland, G.W.L., Seltzer, S.E. and Giess, C.S. 2021. Strategies to Increase Resilience, Team Building, and Productivity Among Radiologists During the COVID-19 Era. *Journal of the American College of Radiology*, 18(5): 675-678. (Online). Available: https://doi.org/10.1016/j.jacr.2020.12.015 (Accessed 27 September 2024).

Fishman, M.D.C., Mehta, T.S., Siewert, B.S., Bender, C.E. and Kruskal, J.B. 2018. The road to wellness: Engagement strategies to help radiologists achieve joy at work. *RadioGraphics*, 38: 1651-1664. (Online). Available: http://doi.org/10.1148/rg.2018180030 (Accessed 10 May 2020).

Flood, T., McFadden, S. and Shepherd, P. 2022. The impact of COVID-19 on the mental health of radiography staff and managers in Northern Ireland, UK: The radiography managers' perspective. *Radiography*, 28 Suppl 1: S27-S34. (Online). Available: https://doi.org/10.1016/j.radi.2022.06.011 (Accessed 21 December 2024).

Florczak, K.L. 2022. Best Available Evidence or Truth for the Moment: Bias in Research. *Nursing Science Quarterly*, 35(1): 20-24. (Online). Available: https://doi.org/10.1177/08943184211051350 (Accessed 21 December 2024).

Ford, J.D, Grasso, D.J., Elhai, J.D. and Courtois, C.A. 2015. Social, cultural, and other diversity issues in the traumatic stress field. *Posttraumatic Stress Disorder*, Aug: 503-546. (Online). Available: https://doi.org/10.1146/annurev.psych.55.090902.141456 (Accessed 27 January 2022).

Foley, S.J., O'Loughlin, A. and Creedon, J. 2020. Early Experiences of Radiographers in Ireland during the COVID-19 Crisis. *Insights into Imaging*, 11(1): 1-8. (Online). Available: https://doi.org/10.1186/s13244-020-00910-6 (Accessed 21 December 2024).

Folkman, S. 2008. The case for positive emotions in the stress process. *Anxiety, Stress, and Coping*, 21(1): 3-14. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/18027121/ (Accessed 15 July 2023).

Folkman, S. and Moskowitz, J.T. Coping: pitfalls and promise. *Annu Rev Psychol*, 55:745-74. (Online). Available: https://www.annualreviews.org/doi/pdf/10.1146/annurev.psych.55.090902.141456 (Accessed 02 August 2023).

Fonseca, M. 2023. *Infographic: Importance of describing the setting of a study in your manuscript.* (Online). Available: https://www.editage.com/insights/importance-of-describing-the-setting-of-a-study-in-your-manuscript (Accessed 23 May 2023).

Forero, R., Nahidi, S., De Costa, J., Mohsin, M., Fitzgerald, G., Gibson, N., McCarthy, S. and Aboagye-Sarfo, P. 2018. Application of four-dimension criteria to assess rigour of qualitative research in emergency medicine. *BMC Health Serv Res*, 18(1): 1-11. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/29454350/ (Accessed 23 March 2023).

Fried, E. I. 2020. Theories and models: What they are, what they are for, and what they are about. *Psychological Inquiry*, 31(4): 336-344. (Online). Available: https://doi.org/10.1080/1047840X.2020.1854011 (Accessed 14 November 2024).

Galea, S., Merchant, R.M. and Lurie, N. 2020. The mental health consequences of COVID-19 and physical distancing: The need for prevention and early intervention. *Journal of American Medical Association*, 180(6): 817-818. (Online). Available: http://doi.org/10.1001/jamainternmed.2020.1562 (Accessed 10 May 2020).

Gam, N.P. 2015. Occupational stressors in diagnostic radiographers working in public health facilities in the eThekwini district of KwaZulu-Natal. M. Tech, Durban University of Technology. (Online). Available: http://ir.dut.ac.za/handle/10321/1414 (Accessed 28 May 2020).

Garba, I., Bashir, H.S., Mohammed, S., Dambele, M., Hikima, M.S., Lawal, Y. and Yahuza, M.A. 2021. Evaluation of inadequately filled radiology request forms with its impact on patient radiation exposure and waiting time in a tertiary care hospital: A preliminary report from Northwest Nigeria. *West African Journal of Radiology,* 28(2): 55-60. (Online). Available: https://www.wajradiology.org/article.asp?issn=1115-3474;year=2021;volume=28;issue=2;spage=55;epage=60;aulast=Garba (Accessed 15 February 2023).

George, G., Quinlan, T. and Reardon, C. 2009. *Human Resources for Health: A Needs and Gaps Analysis of Human Resources for Health in South Africa.* Durban: Health Economics and HIV & AIDS Research Division (HEARD).

Giorgi, G., Lecca, L.I., Alessio, F., Finstad, G.L., Bondanini, G., Lulli, L.G., Arcangeli, G. and Mucci, N. 2020. COVID-19-Related Mental Health Effects in the Workplace: A Narrative Review. *International Journal of Environmental*

Research and Public Health, 17(21). (Online). Available: https://doi.org/10.3390/ijerph17217857 (Accessed 15 October 2024).

Gitau, E. 2020. *Frontline health workers are at great risk due to lack of adequate PPE.* (Online). Available: https://www.africahealthexhibition.com/en/media/covid-19-updates/frontline-health-workers-are-great-risk-due-lack-adequate-ppe.html (Accessed 30 April 2020).

Given, L.M. ed. 2008. Constructivism. In: *The SAGE Encyclopedia of Qualitative Research Methods* (online). Thousand Oaks: SAGE publications. (Online). Available: https://doi.org/10.4135/9781412963909 (Accessed 10 July 2020; 02 August 2023).

Glanz, K., Rimer, B. K. and Viswanath, K. 2015. *Health behavior: Theory, research, and practice*. 5th edition. San Francisco: Jossey-Bass.

Glanz, K. and Bishop, D.B. 2010. The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, 31: 399-418. (Online). Available: https://doi.org/10.1146/annurev.publhealth.012809.103604 (Accessed 25 July 2020).

Gordon, J. 2022. *Sensemaking Theory – Explained.* (Online). Available: https://thebusinessprofessor.com/en_US/management-leadership-organizational-behavior/sensemaking-theory-explained (Accessed 13 August 2023).

Gqweta, B. 2012. Role extension: The needs, perceptions and experiences of South African radiographers in primary health care. *The South African Radiographer*, 50(1): 22-26. (Online). Available: https://sar.org.za/index.php/sar/article/view/191/164 (Accessed 15 March 2023).

Great Schools Partnership. 2014. *The Glossary of Education Reform.* (Online). Available: https://www.edglossary.org/contact/ (Accessed 02 August 2023).

Grime, M.M. and Wright. G. 2016. *Delphi method.* (Online). Available: https://doi.org/10.1002/9781118445112.stat07879 (Accessed 17 July 2020).

Grove, S.K., Burns, N. and Gray, J.R. 2013. *The practice of nursing research. appraisal, synthesis, and generation of evidence*. 7th Edition. California: Elsevier Inc. Saunders.

Guba, E.G. and Lincoln. Y.S. 1994. Competing paradigms in qualitative research. In Denzin N. K. and Lincoln Y. S. eds. *Handbook of qualitative research*. 105–117. California: Sage Publications.

Guttmann, R. 2016. *Transactional Model of Stress and Coping – Richard Lazarus.* (Online). Available: https://commons./wiki/File:Transactional_Model_of_Stress_and_Coping_-_Richard_Lazarus.svg (Accessed 25 June 2020).

Haenssgen, M.J. 2020. *Interdisciplinary qualitative research in global development: A Concise Guide*. Bingley: Emerald Publishing Limited.

Halcomb, E., Gholizadeh, L., Digiacomo, M. and Phillips, J.L. 2007. Literature review: Considerations in undertaking focus group research with culturally and linguistically diverse groups. *Journal of Clinical Nursing*, 16(6): 1000-11. (Online). Available: https://doi.org/10.1111/j.1365-2702.2006.01760.x (Accessed 13 July 2020).

Hall, E., Chai, W. and Albrecht, J.A. A qualitative phenomenological exploration of teachers' experience with nutrition education. *Am J Health Educ*, 47(3): 136-148. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/27226814/ (Accessed 20 June 2023).

Hamlin, K. 2022. *Radiology nurse career overview.* (Online). Available: https://nursejournal.org/careers/radiology-nurse/#:~:text=During%20diagnostic%20imaging%20procedures%2C%20radiology,monitoring%20intravenous%20lines%20and%20catheters (Accessed 15 June 2023).

Hayden, J. 2023. *Introduction to Health Behaviour Theory*. 4th edition. Burlington, Massachusetts: Jones and Bartlett Learning.

Hazell, L.J. and Stork, L.A. 2024. Radiographer experiences of personal protective equipment during COVID-19 in Gauteng, South Africa. *Journal of Medical Imaging and Radiation Sciences*, 55(1): 61-66. (Online). Available: https://doi.org/10.1016/j.jmir.2023.12.002 (Accessed 21 December 2024).

Health Direct. 2023. *What is a radiographer? What is a radiologist?* (Online). Available: https://www.healthdirect.gov.au/what-is-a-radiographer-what-is-a-radiologist (Accessed 02 August 2023).

Health Professions Council of South Africa (HPCSA). 2019. *Annual report 2018/19*. Pretoria: HPCSA. (Online). Available: http://www.hpcsa.co.za/Uploads/Publications (Accessed 12 May 2020).

Health Professions Council of South Africa (HPCSA). 2020. *Professional Board for Radiography and Clinical Technology Scope of Practice: Diagnostic Radiography.* (Online). Available: https://www.studocu.com/in/document/cochin-university-of-science-and-technology/btech-electronics-and-biomedical/10-professional-board-for-radiography-and-clinical-technology-scope-of-practice-diagnostic-radiography-artictle-author-health-professions-council-of-south-africa/40749261 (Accessed 24 March 2023).

Hefner, V. 2017. Variables, moderating types. In *The sage encyclopedia of communication research methods*. Volume 4. SAGE Publications, Inc. (Online).

Available: https://doi.org/10.4135/9781483381411 (Accessed 25 January 2025).

Hemingway, M.A. and Smith, C.S. 1999. Organizational climate and occupational stressors as predictors of withdrawal behaviours and injuries in nurses. *Journal of Occupational and Organizational Psychology*, 72(3): 285-299. (Online). Available: https://doi.org/10.1348/096317999166680 (Accessed 28 May 2020).

Heng, A.L., Ooi, C.C., Wen Eu, B.J., San Kiew, Y., Wong, A.S.K. and Da Zhuang, K. 2020. The bug stops with me: Prevention of COVID-19 nosocomial transmission during radiographic procedures. *Journal of Medical Imaging and Radiation Sciences*, 51(4): 540-545. (Online). Available: https://doi.org/10.1016/j.jmir.2020.07.054 (Accessed 23 February 2021).

Herman, N. Stanford Graduate School of Business. 2020. *COVID-19's impact on business*. (Online). Available: http://libguides.stanford.edu/covid19/ (Accessed 14 May 2020).

Higgins, V., Sohaei, D., Diamandis, E.P and Prassas, I. 2020. COVID-19: from an acute to chronic disease? Potential long-term health consequences, *Critical Reviews in Clinical Laboratory Sciences*, 58(5): 297-310. (Online). Available: https://doi.org/10.1080/10408363.2020.1860895 (Accessed 23 March 2023).

Honebein, P.C. 1996. Seven goals for the design of constructivist learning environments. In Wilson, Brent. G. Ed. *Constructivist learning environments: case studies in instructional design. Educational Technology Publications*. New Jersey: Englewood Cliffs

Human Sciences Research Council. (HSRC). 2024. *KwaZulu-Natal reports second-highest HIV prevalence rate in South Africa - HSRC*. (Online). Available: https://hsrc.ac.za/press-releases/phsb/kwazulu-natal-reports-

second-highest-hiv-prevalence-rate-in-south-africa/ (Accessed 15 January 2025).

Ionising Radiation (Medical Exposure) Regulations. 2017. *UK Statutory Instruments 2017 No. 1322 Regulation 10.* (Online). Available: https://www.legislation.gov.uk/uksi/2017/1322/regulation/10/made (Accessed 23 March 2023).

Ingham, L., Jackson, E. and Purcell, C. 2022. Learning from adversity: Occupational therapy staff experiences of coping during COVID-19. *British Journal of Occupational Therapy*, 85(8): 577-584. (Online). Available: https://doi.org/10.1177/0308022621106449 (15 June 2023).

International Commission on Radiological Protection (ICRP). 2007. *Annals of the ICRP Publication 103.* The 2007 Recommendations of the International Commission on Radiological Protection. (Online). Available: https://www.icrp.org/docs/ICRP_Publication_103-Annals_of_the_ICRP_37(2-4)-Free_extract.pdf (Accessed 23 March 2023).

Ismail, Y., Shiner, N. and Tucker, R. 2024. Workplace factors impacting the wellbeing of diagnostic radiographers in clinical practice: A literature review. *Journal of Medical Imaging and Radiation Sciences*, 55(4): 1-14. (Online). Available: https://doi.org/10.1016/j.jmir.2024.101439 (21 December 2024).

Itani, R., Alnafea, M., Tannoury, M., Hallit, S. and Al Faraj, A. 2021. Shedding Light on the Direct and Indirect Impact of the COVID-19 Pandemic on the Lebanese Radiographers or Radiologic Technologists: A Crisis within Crises. *Healthcare*, 9(3): 1-15. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33807020/ (Accessed 24 June 2023).

Jabareen, Y. 2009. Building a Conceptual Framework: Philosophy, Definitions, and Procedure. *International Journal of Qualitative Methods*, 8(4): 49-62. (Online). Available:

https://journals.sagepub.com/doi/pdf/10.1177/160940690900800406 (Accessed 29 August 2020).

Janz, N.K. and Becker, M.H. 1984. The Health Belief Model: A decade later. *Health Education & Behavior*, 11 (1): 1-47. (Online). Available: https://doi.org/10.1177/109019818401100101 (Accessed 25 July 2020).

Jimah, B.B. 2021. Audit of radiology request form for completion and usefulness of clinical history: Teaching hospital experience, Ghana. *Radiology Research and Practice*, 2021(5583442): 1-5. (Online). Available: https://www.hindawi.com/journals/rrp/2021/5583442/ (Accessed 23 April 2023).

Johnson, R.B. and Christensen, L. 2014. *Educational research: Quantitative, qualitative and mixed approaches*. 5th edition. Thousand Oaks, CA: Sage Publications.

Jordan, S., Watkins, A., Storey, M., Allen, S.J., Brooks, C.J., Garaiova, I., Heaven, M.L., Jones, R., Plummer, S.F., Russell, I.T., Thornton, C.A. and Morgan, G. 2013. Volunteer Bias in Recruitment, Retention, and Blood Sample Donation in a Randomised Controlled Trial Involving Mothers and Their Children at Six Months and Two Years: a Longitudinal Analysis. *PLoS ONE*, 8(7): 1-16. (Online). Available: https://doi.org/10.1371/journal.pone.0067912 (Accessed 25 January 2025).

Jorge, A. and Fridell, K. 2021. In the Eye of the Storm - Radiographers' experience of working with SARS Covid-19 patients. *Journal of Radiology Nursing*, 40(4): 377-383. (Online). Available: https://doi.org/10.1016/j.jradnu.2021.09.005 (Accessed 21 December 2024).

Kagwe, M., Ngigi, S. and Mutisya, S. 2018. Sources of Occupational Stress and Coping Strategies among Teachers in Borstal Institutions in Kenya. *Edelweiss Psyi Open Access,* 2(1): 18-21. (Online). Available:

https://www.semanticscholar.org/paper/Sources-of-Occupational-Stress-and-Coping-among-in-Margaret-Simon/1a6ddb9429c687f5812c7445d3162244b4139aa3 (Accessed 21 December 2024).

Kamarulzaman, W. 2012. Theories of Motivation from Western and Islamic Perspectives: A Theoretical Framework. *SSRN Electronic Journal*. (Online). Available: https://doi.org/10.2139/ssrn.2232841 (Accessed 23 February 2025).

Kang, J.O. 2011. Occupational Infections of Healthcare Personnel in Korea. *Hanyang Medical Reviews*, 31(3): 200-211. (Online). Available: http://doi.org/10.7599/hmr.2011.31.3.200 (Accessed 12 May 2020).

Kang, L., Ma, S., Cheng, M., Wang, Y., Li, R., Yao, L., Bai, H., Cai, Z., Yang, B., Hu, S., Zhang, K., Wang, G., Ma, C. and Liu, Z. 2020. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. *Brain, Behaviour, and Immunity*, 87: 11-17. (Online). Available: https://doi.org/10.1016/j.bbi.2020.03.028 (Accessed 25 July 2020).

Kekana, R.M., Swindon, L.D. and Mathobisa, J.M. 2015. A survey of South African Radiographers' and Radiologists' opinions on role extension for radiographers. *African Journal for Physical, Health Education, Recreation and Dance*, 21(4:1): 1114-1125. (Online). Available: https://www.semanticscholar.org/paper/A-survey-of-South-African-Radiographers%E2%80%99-and-on-for-Kekana-Swindon/c9d6804fe462d6e8927244f753ea6edf47f6566f (Accessed 23 June 2023).

Khatami, F., Saatchi, M., Zadeh, S.S.T., Aghamir, Z.S., Shabestari, A.M., Reis, L.O. and Aghamir, S.M.K. 2020. A meta-analysis of accuracy and sensitivity of chest CT and RT-PCR in COVID-19 diagnosis. *Scientific Reports*, 10(22402):

1-2. (Online). Available: https://doi.org/10.1038/s41598-020-80061-2 (Accessed 13 December 2021).

Kinsinger, F.S. 2009. Beneficence and the professional's moral imperative. *J Chiropr Humanit*, 16(1): 44-46. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3342811/ (Accessed 14 June 2023).

Kim, J. and McKenzie, L.A. 2014. The impacts of physical exercise on stress coping and wellbeing in university students in the context of leisure. *Health*, 6(19): 2570-2580. (Online). Available: https://www.scirp.org/journal/CTA.aspx?paperID=51245 (Accessed 19 July 2023).

Kitchin, R. 2014. *The data revolution: Big data, open data, data infrastructures & their consequences*. Los Angeles Etc.: Sage.

Koch, G., Swindon, L.D. and Pillay, J.D. 2016. Knowledge, clinical competencies and medicolegal responsibilities required for the administration of intravenous contrast media by radiographers. M. Tech, Durban University of Technology. (Online). Available: https://openscholar.dut.ac.za/bitstream/10321/2553/1/KOCH_GGV_2017.pdf (Accessed 23 June 2023).

Kolli, P., Elicker, B., Coakley, F., Cho, K., Fong, C., Hampton, T., Gordon, R., Mackenzie, J. and Zagoria, R. 2018. UCSF Department of Radiology and Biomedical Imaging: *CT and X-ray Contrast Guidelines.* (Online). Available: https://radiology.ucsf.edu/patient-care/patient-safety/contrast/iodinated#:~:text=A%20Radiology%20nurse%20or%20a,general%20supervision%20of%20a%20physician. (Accessed 14 March 2023).

Korstjens, I. and Moser, A. 2018. Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General*

Practice, 24(1): 120–124. (Online). Available: https://doi.org/10.1080/13814788.2017.1375092 (Accessed 30 September 2024).

Kretzschmar, M.E., Rozhnova, G., Bootsma, M.C.J., van Boven, M., van de Wijgert, J.H.H.M. and Bonten, M.J.M. 2020. Impact of delays on effectiveness of contact tracing strategies for COVID-19: A modelling study. *Lancet Public Health*, 5(8): E452-E459. (Online). Available: https://doi.org/10.1016/S2468-2667(20)30157-2 (Accessed 25 June 2021).

KwaZulu Natal Health. 2023. *Health Facilities.* (Online). Available: http://www.kznhealth.gov.za/ (Accessed 12 February 2023).

KwaZulu Natal Transport. 2023. *Provincial and Private Hospitals: Road and Traffic Information.* (Online). Available: http://www.kzntransport.gov.za/rd_traffic/rti/hospitals/index.htm (Accessed 12 February 2023).

Kwee, T.C and Kwee, R.M. 2020. Chest CT in COVID-19: What the radiologist needs to know. *Radiographics*, 40(7): 1848-1865. (Online). Available: https://doi.org/10.1148/rg.2020200159 (Accessed 20 November 2022).

Lambert, S.D. and Loiselle, C.G. 2008. Combining individual interviews and focus groups to enhance data richness. Journal of Advanced Nursing, 62(2): 228-237. (Online). Available: https://doi.org/10.1111/j.1365-2648.2007.04559.x (Accessed 14th September 2024).

LaMorte, W.W. 2022. *Behavioral Change Models: The Health Belief Model.* (Online). Available: https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/BehavioralChangeTheories2.html#headingtaglink_4 (Accessed 23 January 2023).

Larson, R. B. 2019. Controlling social desirability bias. *International Journal of Market Research*, 61(5): 534-547. (Online). Available: https://doi.org/10.1177/1470785318805305 (Accessed 21 December 2024).

Lazarus, R.S. and Folkman, S. 1984. *Stress, appraisal, and coping*. New York: Springer.

Lazarus, R. S., and Folkman, S. 1987. Transactional Theory and research on emotions and coping. *European Journal of Personality*, 1(3): 141-169. (Online). Available: https://journals.sagepub.com/doi/epdf/10.1002/per.2410010304 (Accessed 22 January 2022).

LeBlanc, V.R. 2009. The effects of acute stress on performance: Implications for health professions education. *Academic Medicine*, 84(10): S25–S33. (Online). Available: https://doi.org/10.1097/acm.0b013e3181b37b8f. (Accessed 22 January 2022).

Lee, J.H., Cho, J., Kim, Y.J., Im, S.H., Jang, E.S., Kim, J.-W., Kim, H.B. and Jeong, S.-H. 2017. Occupational blood exposures in health care workers: incidence, characteristics, and transmission of bloodborne pathogens in South Korea. *BMC Public Health*, 17(1): 1-8. (Online). Available: https://doi.org/10.1186/s12889-017-4844-0 (Accessed 15 December 2024).

Leeds Teaching Hospitals. 2023. *Role of the nurse* (Online). Available: https://www.leedsth.nhs.uk/a-z-of-services/radiology/radiology-departments/radiology-theatre/meet-the-team/role-of-the-nurse/ (Accessed 15 June 2023).

Leite, D.F.B., Padilha, M.A.S., Cecatti, J.G. 2019. Approaching literature review for academic purposes: The Literature Review Checklist. *Clinics,* 74(E1403): 1-8. (Online). Available: https://doi.org/10.6061/clinics/2019/e1403 (Accessed 12 May 2021).

Leung, T.Y.M., Chan, A.Y.L., Chan, E.W., Chan, V.K.Y., Chui, C.S.L., Cowling, B.J., Gao, L., Ge, M.Q., Hung, I.F.N., Ip, M.S.M., Ip, P., Lau, C.S., Lau, L.K.W., Leung, W.K., Li, X., Luo, H., Man, K.K.C., Ng, V.W.S., Siu, C.W., Wan, E.Y.F., Wing, Y.K., Wong, C.S.M., Wong, K.H.T. and Wong, I.C.K. 2020. Short- and potential long-term adverse health outcomes of COVID-19: a rapid review. *Emerging Microbes and Infections*, 9(1): 2190-2199. (Online). Available: https://doi.org/10.1080/22221751.2020.1825914 (Accessed 23 March 2023).

Levering, B. 2002. Concept analysis as empirical method. *International Journal of Qualitative Methods*, 1(1): 35-48. (Online). Available: https://journals.sagepub.com/doi/10.1177/160940690200100104 (Accessed 23 December 2022).

Lewis, S. 2022. Two years on and four waves later: Johannesburg diagnostic radiographers' experiences of COVID-19. *Journal of Medical Imaging and Radiation Sciences*, 54(2) Suppl: S77-S84. (Online). Available: https://doi.org/10.1016/j.jmir.2022.11.012 (Accessed 21 December 2024).

Lewis, S. and Mulla, F. 2020. Diagnostic radiographers' experience of COVID-19, Gauteng South Africa. *Radiography*, 27(2): 346-351. (Online). Available: https://doi.org/10.1016/j.radi.2020.09.009 (Accessed 12 July 2021).

Lewis, S. 2023. Two years on and four waves later: Johannesburg diagnostic radiographers' experiences of COVID-19. *Journal of Medical Imaging and Radiation Sciences,* 54(Suppl.2): S77-S84. (Online). Available: https://doi.org/10.1016/j.jmir.2022.11.012 (Accessed 14 July 2023).

Li, K., Wu, Q., Li, H., Sun, H., Xing, Z., Li, L. and Chen, H. 2023. Multiomic characterisation of the long-term sequelae of SARS survivors: a clinical observational study. *eClinical Medicine*, 58(101884): 1-13. (Online). Available: https://doi.org/10.1016/j.eclinm.2023.101884 (Accessed 23 April 2023).

Li, W., Yang, Y., Liu, Z., Zhao, Y., Zhang, Q., Zhang, L., Cheung, T. and Xiang, Y. 2020. Progression of mental health services during the COVID-19 outbreak in China. *International Journal of Biological Sciences*, 16(10): 1732-1738. (Online). Available: https://doi.org/10.7150/ijbs.45120 (Accessed 15 May 2020).

Liu, X., Kakade, M., Fuller, C.J., Fan, B., Fang, Y., Kong, J., Guan, Z. and Wu, P. 2012. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Comprehensive Psychiatry,* 53: 15-23. (Online). Available: https://doi.org/10.1016/j.comppsych.2011.02.003 (Accessed 25 June 2020).

Loewenstein, K., Barroso, J. and Phillips, S. 2019. The Experiences of Parents in the Neonatal Intensive Care Unit: An Integrative Review of Qualitative Studies Within the Transactional Model of Stress and Coping. *J Perinat Neonatal Nurs,* 33(4): 340-349. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/31651628/ (Accessed 23 February 2023).

Lowe, C. and Heath, N. 2019. Adequate completion of radiology request forms at Newcastle Dental Hospital: A two-cycle audit. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, 128(4): E155. (Online). Available: https://doi.org/10.1016/j.oooo.2019.01.018 (Accessed 23 May 2023).

Lucas, P.J., Baird, J., Arai, L., Law, C. and Roberts, H.M. 2007. Worked examples of alternative methods for the synthesis of qualitative and quantitative Research in systematic reviews. *BMC Medical Research Methodology*, 7(1). (Online). Available: https://doi.org/10.1186/1471-2288-7-4 (Accessed 23 September 2024).

Lund, C. A. 2023. New Mental Health Policy for South Africa. *Mental Health Matters*, 10(3). (Online). Available: https://journals.co.za/doi/abs/10.10520/ejc-menhm_v10_n3_a1 (Accessed 27 September 2024).

Maaleki, A. 2018. *The ARZESH Competency Model: Appraisal & Development Manager's Competency Model*. Chişinău: Lambert Academic Publishing.

Maizlin, N.N. and Ohorodnyk, P. 2020. Investigating the initial effect of COVID-19 on the functioning of outpatient diagnostic imaging facilities. *J Med Imaging Radiat Sci*, 51(4):574-578. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33121887/ (Accessed 23 December 2021).

Makanjee, C.R., Hartzer, Y.F. and Uys, I.L. 2006. The effect of perceived organizational support on organizational commitment of diagnostic imaging radiographers. *Radiography*, 12(2): 118-126. (Online). Available: https://doi.org/10.1016/j.radi.2005.04.005 (Accessed 12 October 2024).

Malangu, N. and Legothoane, A. 2012. Analysis of occupational infections among health care workers in Limpopo province of South Africa. *Global Journal of Health Science*, 5(1): 44-51. (Online). Available: https://doi.org/10.5539/gjhs.v5n1p44 (Accessed 10 June 2020).

Malle, B.F. 2004. *How the mind explains behavior: Folk explanations, meaning, and social interaction*. Cambridge: MIT Press.

Mandal, J., Acharya, S. and Parija, S.C. 2011. Ethics in human research. *Trop Parasitol*, 1(1): 2-3. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3593469/ (Accessed 14 June 2023).

Manser, T. 2009. Teamwork and patient safety in dynamic domains of healthcare: a review of the literature. *Acta Anaesthesiologica Scandinavica*, 53(2): 143-151. (Online). Available: https://www.hrhresourcecenter.org/node/6134.html (Accessed 18 July 2020).

Mantovani, C. 2020. Over 90,000 health workers infected with COVID-19 worldwide: Nurses' group. *Reuters*. 6 May. (Online). Available:

http://www.amp/s/mobile.reuters.com/article/amp/idUSKBN22I1XH (Accessed 14 May 2020).

Martini, C., Risoli, C., Nicolò, M., Tombolesi, A., Negri, J., Brazzo, O., Rigott, I.G., Di Feo, D., Antonucci, G.W., Barbato, L., Pedrazzi, G., Presti, L.L., Santos, J., Migliorini, M., Conversi, L., Vetti, E. and Devetti, A. 2022. COVID-19 outbreak impact on health professionals: a survey on the Italian radiographer experience. *Journal of Medical Imaging and Radiation Sciences,* 53(2): 212-218. (Online). Available: https://doi.org/10.1016/j.jmir.2022.02.006 (Accessed 21 December 2024).

Maxwell, J.A. 2013. *Qualitative Research Design: An Interactive Approach*. 3rd edition. California: Sage Publications.

McAlonan, G.M., Lee, A.M., Cheung, V., Cheung, C., Tsang, K.W.T., Sham, P.C., Chua, S.E. and Wong, J.G.W.S. 2007. Immediate and sustained psychological impact of an emerging infectious disease outbreak on healthcare workers. *The Canadian Journal of Psychiatry*, 52(4): 241-247 (Online). Available: https://doi.org/10.1177/070674370705200406 (Accessed 26 June 2020).

McCombes, S. 2020. *What is a Theoretical Framework? | A Step-by-Step Guide.* (Online). Available: https://www.scribbr.co.uk/author/shona/page/3/ (Accessed 12 January 2023).

Mc Fadden, S., Flood, T., Shepherd, P. and Gilleece, T. 2022. Impact of COVID-19 on service delivery in radiology and radiotherapy, *Radiography*, 28(Suppl.1): S16-S26. (Online). Available: https://doi.org/10.1016/j.radi.2022.03.009 (Accessed 30 March 2023).

McGaghie, W.C., Bordage, G. and Shea, J.A. 2001. Problem statement, conceptual framework, and research question. *Academic Medicine*, 76(9): 923-924. (Online). Available:

https://journals.lww.com/academicmedicine/Fulltext/2001/09000/Medical_and_Veterinary_Students__Structural.21.aspx (Accessed 12 September 2020).

Mchunu, G.G., Harris, O. and Nxumalo, C.T. 2022. Exploring primary healthcare practitioners' experiences regarding the coronavirus disease 2019 (COVID-19) pandemic in KwaZulu-Natal, South Africa. *Primary Health Care Research & Development*, 23(E67): 1-13. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/36330843/ (Accessed 04 January 2023).

Mcleod, S. 2023. *Attribution Theory in Psychology: Definition & Examples.* (Online). Available: https://www.simplypsychology.org/attribution-theory.html (Accessed 23 July 2023).

Mengistu, D.A., Tolera, S.T. and Demmu, Y.M. 2021. Worldwide Prevalence of Occupational Exposure to Needle Stick Injury among Healthcare Workers: A Systematic Review and Meta-Analysis. *Canadian Journal of Infectious Diseases and Medical Microbiology*, 2021: 1-10. Available: https://doi.org/10.1155/2021/9019534 (Accessed 15 December 2024).

McIntosh, M.J. and Morse, J.M. 2015. Situating and Constructing Diversity in semi-structured Interviews. *Global Qualitative Nursing Research*, 2(1): 1–12. (Online). Available: https://journals.sagepub.com/doi/pdf/10.1177/2333393615597674 (Accessed 15 January 2025).

Mental Health Foundation (MHF). 2021. *Stress.* (Online). Available: https://www.mentalhealth.org.uk/explore-mental-health/a-z-topics/stress (Accessed 23 February 2022).

Michaud, K., Matheson, K., Kelly, O. and Anisman, H. 2008. Impact of stressors in a natural context on release of cortisol in healthy adult humans: A meta-analysis. *Stress*, 11(3): 177-197. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/18465466/ (Accessed 21 July 2021).

Miles, M.B., Huberman, A.M. and Saldaña, J. 2014. *Qualitative data analysis: A Methods Sourcebook*. 3rd edition. Thousand Oaks: SAGE.

Mind. 2022. *What can I do to help myself cope?* (Online). Available: https://www.mind.org.uk/need-urgent-help/what-can-i-do-to-help-myself-cope/ (Accessed 23 May 2022).

Mkhize, N., Tiwari, R., Chikte, U. and Pitcher, R. 2022. Temporal trends in the South African diagnostic radiology workforce (2002-2019). *Cureus,* 14(7): E27148. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9392860/#:~:text=Diagnostic%20radiographers%20showed%20female%20predominance,from%2010%25%20to%2017%25 (Accessed 15 June 2023).

Mockaitis, A.I., Butler, C.L. and Ojo, A. 2022. COVID-19 pandemic disruptions to working lives: A multilevel examination of impacts across career stages. *Journal of Vocational Behavior,* 138(103768): 1-16. (Online). Available: https://www.sciencedirect.com/science/article/pii/S0001879122000793 (Accessed 15 June 2023).

Modisakeng, C., Matlala, M., Godman, B., and Meyer, J. C. 2020. Medicine shortages and challenges with the procurement process among public sector hospitals in South Africa; findings and implications. *BMC Health Services Research*, 20(234): 1-10 (Online). Available: https://doi.org/10.1186/s12913-020-05080-1 (Accessed 18 December 2022).

Mohamed Afif, A., Abdul Razak, H. and Choong, A. 2023. COVID-19 pandemic experience of diagnostic radiographers: A Singapore survey. *Journal of Medical Imaging and Radiation Sciences*, 54(2) Suppl: S62-S69. (Online). Available: https://doi.org/10.1016/j.jmir.2023.01.010 (Accessed 21 December 2024).

Mohamed, S., Rosenkrantz, A.B. and Recht, M.P. 2020. Preventing burnout in the face of growing patient volumes in a busy outpatient CT Suite: A

technologist perspective. *Current Problems in Diagnostic Radiology*, 49(2): 70-73. (Online). Available: https://www.sciencedirect.com/science/article/abs/pii/S036301881930026X (Accessed 29 May 2020).

Mohapatra, R.K., Pintilie, L., Kandi, V., Sarangi, A.K., Das, D., Sahu, R. and Perekhoda, L. 2020. The recent challenges of highly contagious COVID-19, causing respiratory infections: Symptoms, diagnosis, transmission, possible vaccines, animal models, and immunotherapy. *Chem Biol Drug Des.*, 96(5): 1187-1208. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7405220/#:~:text=The%20novel%20COVID%E2%80%9019%20is,%2C%20a%20fomite)%20is%20uncertain (Accessed 23 January 2023).

Moon, K. and Blackman, D. 2014. A guide to understanding social science research for natural scientists. *Conserv Biol*, 28(5): 1167-77. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/24962114/ (Accessed 23 February 2021).

Moon, K. and Blackman, D. 2017. *A guide to ontology, epistemology, and philosophical perspectives for interdisciplinary researchers*. (Online). Available: https://i2insights.org/2017/05/02/philosophy-for-interdisciplinarity/ (Accessed 23 February 2021).

Mossa-Basha, M., Meltzer, C.C., Kim, D.C., Tuite, M.J., Kolli, K.P. and Tan, B.S. 2020. Radiology Department Preparedness for COVID-19: Radiology Scientific Expert Review Panel. *Radiology*, 296(2): E106-E112. (Online). Available: https://pubs.rsna.org/doi/epdf/10.1148/radiol.2020200988 (Accessed 23 June 2021).

Mossburg, S., Agore, A., Nkimbeng, M. Commodore-Mensah, Y. 2019. Occupational Hazards among Healthcare Workers in Africa: A systematic review. *Annals of Global Health*, 85(1): 1-13. (Online). Available: https://doi.org/10.5334/aogh.2434 (Accessed 23 June 2020).

Mukhtar, S. 2020. Mental health and emotional impact of COVID-19: Applying Health Belief Model for medical staff to general public of Pakistan. *Brain Behav Immun.*, 87: 28-29. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7151322/ (Accessed 30 July 2020).

Mulder, P. 2017. *Delphi Technique*. (Online). Available: https://www.toolshero.com/decision-making/delphi-technique/ (Accessed 21 July 2020).

Mumbauer, A., Strauss, M., George, G., Ngwepe, P., Bezuidenhout, C., de Vos, L. 2021. Employment preferences of healthcare workers in South Africa: Findings from a discrete choice experiment. *PLoS ONE* 16(4): e0250652. (Online). Available: https://doi.org/10.1371/journal.pone.0250652 (Accessed 15 June 2023).

Munro, L., Isaacs, F., Friedrich-Nel, H. and Swindon, L. 2012. An analysis of the need for accredited training on the administration of intravenous contrast media by radiographers: results of an online survey. *The South African Radiographer*, 50(2): 27-34. (Online). Available: https://sar.org.za/index.php/sar/article/view/232/176 (Accessed 23 June 2023).

Murphy, M., Moore, N., Leamy, B., England, A., O'Connor, O.J. and McEntee, M.F. 2022. An evaluation of the impact of the Coronavirus (COVID 19) pandemic on interventional radiographers' wellbeing. *Journal of Medical Imaging and Radiation Sciences*, 53(3): 384-395. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9114273/ (Accessed 12 January 2023).

Mutala, T.M., Onyambu, C.K and Aywak, A.A. 2020. Radiology practice in sub-Saharan Africa during the COVID-19 outbreak: points to consider. *Pan African Medical Journal*, 37(28): 1-8. (Online). Available: https://www.panafrican-med-journal.com/content/article/37/28/full/ (Accessed 21 January 2022).

Naaman, R., Risper, W., Makila, L. and Juma, I. 2015. An inquiry into definition of ethics. *Comprehensive Academic Journal of Social Sciences*, 2(45): 1-11. Available: https://www.academia.edu/8919935/An_Inquiry_into_Definition_of_Ethics (Accessed 14 June 2023).

Nagao, Y., Baba, H., Torii, K., Nagao, M., Hatakeyama, K., Iinuma, Y., Ichiyama, S., Shimokata, K. and Ohta, M. 2007. A long-term study of sharps injuries among health care workers in Japan. *American Journal of Infection Control*, 35(6): 407-411. (Online). Available: https://doi.org/10.1016/j.ajic.2006.03.015 (Accessed 15 December 2024).

Naidich, J.J., Boltyenkov, A., Wang, J.J., Chusid, J., Hughes, D. and Sanelli, P.C. 2020. Impact of the Coronavirus Disease 2019 (COVID-19) Pandemic on Imaging Case Volumes. *J Am Coll Radiol*, 17(7): 865-872. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/32425710/ (Accessed 23 December 2021).

Naidoo, T., Tomita, A. and Paruk, S. 2020. Burnout, anxiety and depression risk in medical doctors working in KwaZulu-Natal Province, South Africa: Evidence from a multi-site study of resource-constrained government hospitals in a generalised HIV epidemic setting. *PLOS ONE*, 15(10): 1-14. (Online). Available: https://doi.org/10.1371/journal.pone.0239753 (Accessed 21 December 2024).

Natembeya, M.C., Anudjo, M. N. K., Ackah, J.A., Osei, M.B. and Akudjedu, T.N. 2024. The environmental sustainability implications of contrast media supply chain disruptions during the COVID-19 pandemic: A document analysis of

international practice guidelines. *Radiography*, 30: 43–54 (Online). Available: https://doi.org/10.1016/j.radi.2024.05.017 (Accessed 17 June 2025).

National Careers Services (NCS). 2020. *Explore careers: receptionist.* (Online). Available: https://nationalcareers.service.gov.uk/job-profiles/receptionist (Accessed 15 June 2023).

National Health Service (NHS). 2023. *Long-term effects of COVID-19 (long COVID).* (Online). Available: https://www.nhs.uk/conditions/covid-19/long-term-effects-of-covid-19-long-covid/ (Accessed 23 April 2023).

National Institute of Communicable Diseases (NICD). 2020. *First case of COVID-19 Coronavirus reported in SA.* (Online). Available: https://www.nicd.ac.za/first-case-of-covid-19-coronavirus-reported-in-sa/ (Accessed 19 November 2020).

National Institute for Occupational Safety and Health (NIOSH). 2008. *Exposure to stress: Occupational Hazards in Hospitals*. (Online). Available: http://www.cdc.gov/niosh/docs/2008-136/default.html (Accessed 13 May 2020).

National Library of Medicine. 2023. *Medical Encyclopaedia: Imaging and radiology.* (Online). Available: https://medlineplus.gov/ency/article/007451.htm (Accessed 02 August 2023).

Naylor, S., Booth, S., Harvey-Lloyd, J. and Strudwick, R. 2021. Experiences of diagnostic radiographers through the Covid-19 pandemic. *Radiography*, 28(1): 187–192. (Online). Available: https://doi.org/10.1016/j.radi.2021.10.016 (Accessed 21 December 2024).

Neimeyer, R.A and Levitt. H. 2001. Constructivism/constructivist methodology. In book: *International Encyclopedia of the Social and Behavioral Sciences*. Florida: Elsevier Science (Online). Available:

https://www.researchgate.net/publication/298430839_Constructivismconstructivist_methodology (Accessed 28 May 2020).

Nightingale, J. and Hogg, P. 2003. Clinical practice at an advanced level: an introduction. *Radiography*, 9(1): 77-83. (Online). Available: https://doi.org/10.1016/S1078-8174(03)00005-1 (Accessed 15 March 2023).

Niu, Y., Xian, J., Lei, Z., Liu, X. and Sun, Q. 2020. Management of infection control and radiological protection in diagnostic radiology examination of COVID-19 cases. *Radiat Med Pro*, 1(2): 75-80. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/32835346/ (Accessed 23 February 2023).

Nilsen, P. 2015. Making sense of implementation theories, models and frameworks. *Implement Sci*, 10(53): 1-13. (Online). Available: https://implementationscience.biomedcentral.com/articles/10.1186/s13012-015-0242-0 (Accessed 15 June 2023).

Nurse Key. 2017. *Understanding Theory and Research Frameworks.* (Online). Available: https://nursekey.com/understanding-theory-and-research-frameworks/#:~:text=The%20relational%20statements%20are%20what,variables%20using%20specific%20statistical%20tests. (Accessed 15 July 2023).

Nyumba, T.O., Wilson, K., Derrick, C.J. and Mukherjee, N. 2018. Qualitative methods for eliciting judgements for decision making: The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution*, 9: 20-32. (Online). Available: https://doi.org/10.1111/2041-210X.12860 (Accessed 14 June 2020).

Oandasan, I.F., Baker, G.R., Jones, L. and Lemieux-Charles, L. 2006. *Teamwork in healthcare: promoting effective teamwork in healthcare in Canada: Policy synthesis and recommendations.* (Online). Available: https://www.hrhresourcecenter.org/node/6135.html (Accessed 18 July 2020).

O'Boyle, C., Robertson, C. and Secor-Turner, M. 2006. Nurses' beliefs about public health emergencies: Fear of abandonment. *American Journal of Infection Control*, 34(6): 351-357. (Online). Available: https://doi.org/10.1016/j.ajic.2006.01.012351 (Accessed 15 July 2020).

O'Donnell, M.R., Jarand, J., Loveday, M., Padayatchi, N., Zelnick, J., Werner, L., Naidoo, K., Master, I., Osburn, G., Kvasnovsky, C., Shean, K., Pai, M., Van der Walt, M., Horsburgh, C.R. and Dheda, K. 2010. High incidence of hospital admissions with multidrug resistant and extensively drug resistant tuberculosis among South African health care workers. *Annals of Internal Medicine*, 153(8): 516-522. (Online). Available: https://doi.org/10.1059/0003-4819-153-8-201010190-00008 (Accessed 12 July 2020).

Oleaga, L. 2020. How is the pandemic affecting radiology practice? *Health Manag*, 20(4): 310-312. (Online) Available: https://healthmanagement.org/c/healthmanagement/issuearticle/how-is-the-pandemic-affecting-radiology-practice (Accessed 27 September 2024).

Olejarczyk, J.P. and Young, M. 2022. *Patient Rights and Ethics*. (Online). Available: https://www.ncbi.nlm.nih.gov/books/NBK538279/ (Accessed 14 June 2023).

Omidiji, O.A.T., Atalabi, O.M., Idowu, E.A., Ishola, A., Olowoyeye, O.A., Omisore, A.D., Eze, K.C., Ahmadu, M.S., Dim, N.R., Anas, I., Ilo, A.C., Ayodele, S.A., Daji, F.Y., Yidi, A.M., Ajiboye, O.K., Jimoh, K.O., Toyobo, O.O., Onuwaje, A.M., Irurhe, N.K. and Adeyomoye, A.O. 2022. COVID-19: Challenges and Coping Strategies in Radiology Departments in Nigeria. *Annals of African Medicine*, 21(1): 71-76. (Online). Available: https://doi.org/10.4103/aam.aam_76_21 (Accessed 27 September 2024).

Onwuegbuzie, A.J. and Frels, R. 2016. *7 steps to a comprehensive literature review: a multimodal & cultural approach.* Los Angeles: SAGE.

Ord, A.A., Zamparini, J., Lorentz, L., Ranchod, A. and Moodley H. 2022. A study of the chest imaging findings of adult patients with COVID-19 on admission to a tertiary hospital in Johannesburg. *Southern African Journal of Infectious Diseases*, 37(1): 1-10 (Online). Available: https://doi.org/10.4102/sajid.v37i1.449 (Accessed 13 November 2022).

Organization for Economic Co-operation and Development (OECD). 2020. *Employment rate by age group* (indicator). (Online). Available: https://data.oecd.org/emp/employment-rate-by-age-group.htm (Accessed 30 June 2020).

O'Sullivan, O. 2021. Long-term sequelae following previous coronavirus epidemics. *Clinical Medicine*, 21(1): E68-70. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33144403/ (Accessed 13 February 2023).

Oxford English Dictionary. 2023. *lockdown, n. meanings, etymology and more | Oxford English Dictionary.* (Online). Available: https://doi.org/10.1093//OED//9115757445 (Accessed 15 January 2025).

Oxford Learners Dictionaries. 2025. *Decentralize verb - Definition, pictures, pronunciation and usage notes | Oxford Advanced American Dictionary at OxfordLearnersDictionaries.com.* (Online). Available: https://www.oxfordlearnersdictionaries.com/definition/american_english/decentralize (Accessed 15 January 2025).

Palmieri, P.A. and Peterson. L.T. 2009. Attribution Theory and Healthcare Culture: Translational management science contributes a framework to identify the etiology of punitive clinical environments. *Advances in Health Care Management*, 8: 81-111. (Online). Available: https://doi.org/10.1108/S1474-8231(2009)0000008008 (Accessed 15 July 2020).

Panchal, N., Saunders, H., Rudowitz, R. and Cox, C. 2023. *The Implications of COVID-19 for Mental Health and Substance Use*. (Online). Available:

https://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/ (Accessed 24 July 2023).

Pannucci, C.J. and Wilkins, E.G. 2011. Identifying and Avoiding Bias in Research. *Plastic and Reconstructive Surgery*, 126(2): 619–625. (Online). Available: https://pmc.ncbi.nlm.nih.gov/articles/PMC2917255/ (Accessed 21 December 2024).

Parag, P. and Hardcastle, T.C. 2022. Shortage of Radiologists in Low to Middle Income Countries in the Interpretation of CT scans in Trauma. *Bangladesh Journal of Medical Science*, 21(3): 489-491. (Online). Available: https://doi.org/10.3329/bjms.v21i3.59560 (Accessed 18 October 2024).

Patel, K., Nadel, J. and West, M. 2014. *Redesigning the care team: The critical role of frontline workers and models for success.* (Online). Available: www.brookings.edu/wp-content/uploads/2016/06/FINAL-Hitachi-Toolkit-32014 (Accessed: 05 June 2020).

Patel, S. 2015. *The research paradigm- methodology, epistemology and ontology- explained in simple language.* (Online). Available: https://salmapatel.co.uk/academia/the-research-paradigm-methodology-epistemology-and-ontology-explained-in-simple-language/ (Accessed 23 February 2021).

Patton, M.Q. 2002. *Qualitative research and evaluation methods*. 3rd ed. Thousand Oaks: Sage.

Pietkiewicz, I. and Smith, J. 2014. A practical guide to using interpretative phenomenological analysis in qualitative research psychology. *Psychological Journal*, 20(1): 7-14. (Online). Available: https://doi.org/10.14691/CPPJ.20.1.7 (Accessed 27 July 2020).

Peitl, V., Zatelazo, V.G. and Karlovic, D. 2020. Mental Health Issues and Psychological Crisis Interventions during the COVID-19 Pandemic and Earthquakes in Croatia. *Archives of Psychiatry Research*, 56: 193-198. (Online). Available: http://doi.org/10.20471/dec.2020.56.02.07 (Accessed 10 May 2020).

Prabhakar, N., Prabhakar, A. and Garg, M. 2021. Chest CT in "Post" COVID-19: What the radiologist must know. *Radiographics*, 2021. 41(2): E66-E67. (Online). Available: https://doi.org/10.1148/rg.2021200213 (Accessed 23 April 2023).

Prüss-Üstün, A., Rapiti, E. and Hutin, Y. 2005. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *American Journal of Industrial Medicine*, 48(6): 482-490. (Online). Available: https://doi.org/10.1002/ajim.20230 (Accessed 15 December 2024).

Rajkumar, R.P. 2020. COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry*, 52: 1-5. (Online). Available: https://doi.org/10.1016/j.ajp.2020.102066 (Accessed 15 July 2020).

Ramphul, K., Mejias, S.G. and Ramphul, Y. 2020. Headache may not be linked with severity of coronavirus disease 2019 (COVID-19). *World J Emerg Med,* 11(4): 274. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7517395/ (Accessed 14 November 2020).

Rapiti, E., Pruss-Ustun, A. and Hutin, Y. 2005. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *American Journal of Industrial Medicine*, 48(6): 482-90. (Online). Available: https://doi.org/10.1002/ajim.20230 (Accessed 23 June 2020).

Reid, K., Flowers, P. and Larkin, M. 2005. Exploring the lived experience. *The Psychologist*, 18(1): 20-23. (Online). Available:

https://web.archive.org/web/20110125025910/http://www.thepsychologist.org.uk/archive/archive_home.cfm/volumeID_18-editionID_114-ArticleID_798-getfile_getPDF/thepsychologist/0105reid.pdf (Accessed 23 April 2023).

Roberge, R.J. 2016. Face shields for infection control: A review. *Journal of occupational and environmental hygiene*, 13(4): 235-242. (Online). Available: https://doi.org/10.1080/15459624.2015.1095302 (Accessed 15 January 2025).

Robinson, O. C. 2013. Sampling in interview-based qualitative research: A theoretical and practical guide. Qualitative research in Psychology, 11(1): 25-41. (Online). Available: https://doi.org/10.1080/14780887.2013.801543 (Accessed 15 September 2024).

Rosenstock, I.M., Strecher, V.J. and Becker, M.H. 1988. Social learning theory and the health belief model. *Health Education & Behavior*, 15(2): 175-183. (Online). Available: https://doi.org/10.1177/109019818801500203 (Accessed 25 July 2020).

Ross, P.T and Zaidi, N.L. 2019. Limited by our limitations. *Perspect Med Educ*, 8(4): 261-264. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/31347033/ (Available: 24 July 2023).

Rousan, L.A., Elobeid, E., Karrar, M. and Khader, Y. 2020. Chest x-ray findings and temporal lung changes in patients with COVID-19 pneumonia. *BMC Pulmonary Medicine*, 20(245): 1-9. (Online). Available: https://doi.org/10.1186/s12890-020-01286-5 (Accessed 12 February 2023).

Royal Australian and New Zealand College of Radiologists (RANZCR). 2020. *COVID-19 Updates*. (Online). Available: https://www.ranzcr.com/our-work/coronavirus (Accessed 21 January 2023).

Royal College of Radiologists (RCR). 2021. *Adequate Completion of Radiology Request Forms.* (Online). Available: https://www.rcr.ac.uk/audit/adequate-completion-radiology-request-forms-qsi-ref-xr-501 (Accessed 24 June 2023).

Royal College of Radiologists (RCR) and Society and College of Radiographers (SCR) 2012. *Team working in medical imaging.* (Online). Available: https://www.rcr.ac.uk/publication/team-working-clinical-imaging (Accessed 15 March 2023).

Rural Health Information Hub (RHIH). 2018. *Rural Health Promotion and Disease Prevention Toolkit.* (Online). Available: https://www.ruralhealthinfo.org/toolkits/health-promotion/about-this-toolkit (Accessed 29 December 2020).

Rycroft-Malone, J. and Bucknall, T. ed. 2010. *Models and frameworks for implementing evidence-based practice: Linking evidence to action*. Oxford: Wiley-Blackwell.

Salazar de Pablo, G., Vaquerizo-Serrano, J., Catalan, A., Arango, C., Moreno, C., Ferre, F., Shin, J.I., Sullivan, S., Brondino, N., Solmi, M. and Fusar-Poli, P. 2020. Impact of coronavirus syndromes on physical and mental health of health care workers: Systematic review and meta-analysis. *Journal of Affective Disorders*, 275: 48-57. Available: https://doi.org/10.1016/j.jad.2020.06.022 (Accessed 15 October 2024).

Salih, S., Alkatheeri, A., Almarri, B., Shamsi, N.A., Jaafari, O. and Alshammari, M. 2022. The impact of COVID-19 crisis on the control and management of radiography practice in the United Arab Emirates. *Healthcare*, 10(1546): 1-11. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9408335/ (Accessed 23 February 2023).

Sekyere, E., Bohler-Muller, N., Hongoro, C. Makoae, M. 2020. *The impact of COVID-19 in South Africa.* (Online). Available:

https://www.wilsoncenter.org/publication/impact-covid-19-south-africa (Accessed 29 June 2020).

Shah, S. 2019. *7 Biases to avoid in qualitative research*. (Online). Available: https://www.editage.com/insights/7-biases-to-avoid-in-qualitative-research (Accessed 21 December 2024).

Shanahan, M.C. and Akudjedu, T.N. 2021. Australian radiographers' and radiation therapists' experiences during the COVID-19 pandemic. *J Med Radiat Sci*, 68(2): 111-120. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33590670/ (Accessed 22 May 2023).

Shahid, A., Arif, K., Sarfraz, S., Javed, A., Ikram, M. and Ammara Ihsan, A. 2022. Challenges and Coping Strategies of Radiology Doctors During COVID-19 Era, Lahore, Pakistan. *Journal of Ecophysiology & Occupational Health*, 22(1): 8-14. (Online). Available: https://doi.org/10.18311/jeoh/2022/29216 (Accessed 23 September 2024).

Šimundić, A.-M. 2013. Bias in Research. *Biochemia Medica*, 23(1): 12-15. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3900086/ (Accessed 21 December 2024).

Singh, K. 2020. KwaZulu-Natal sees a rise in Covid-19 infections among healthcare workers. *News24*, 13 December. (Online). Available: https://www.news24.com/news24/southafrica/news/kwazulu-natal-sees-a-rise-in-covid-19-infections-among-healthcare-workers-20201213 (Accessed 03 January 2021).

Sipos D, Jenei T, Kövesdi OL, Novák P, Freihat O, Tollár J, András Pandur A, Kovács Á, Repa I, Petőné Csima M. 2023. Burnout and occupational stress among Hungarian radiographers working in emergency and non-emergency departments during COVID-19 pandemic. *Radiography*, 29(3): 466-472.

(Online). Available: https://doi.org/10.1016/j.radi.2023.02.013 (Accessed 21 December 2024).

Smaldino, P.E. 2020. How to translate a verbal theory into a formal model. *Social Psychology*, 51(4): 207-218. (Online). Available: https://doi.org/10.1027/1864-9335/a000425 (Accessed 14 November 2024).

Smith, J.A., Flowers, P. and Larkin, M. 2009. *Interpretative phenomenological analysis: Theory, method and research*. 2nd edition. London: Sage Publications.

Smith, J.A., Flowers, P. and Larkin, M. 2022. *Interpretative phenomenological analysis: Theory, method and research*. London: Sage Publications.

Smith, J. and Noble, H. 2014. Bias in research. *Evidence-Based Nursing*, 17(4): 100-101 (Online). Available: https://doi.org/10.1136/eb-2014-101946 (Accessed 05 January 2025).

Smith, J.A. and Osborn, M. 2007. *Qualitative psychology: Interpretative phenomenological analysis.* (Online). Available: http://www.sagepub.com/upmdata/17418_04_Smith_2e_Ch_04.pdf (Accessed 23 June 2020).

Society of Radiographers (SoR). 2020. *Contrast media and drugs: Update for radiographers administering contrast agents using a patient group direction.* (Online). Available: https://www.sor.org/news/contrast-media-and-drugs/update-for-radiographers-administering-contrast-ag (Accessed 14 March 2023).

Society of Radiographers (SoR). 2022. *Radiography careers.* (Online). Available: https://www.collegeofradiographers.ac.uk/getmedia/a3642d8b-3bdd-438f-8cc4-15c4615f811d/radiography-careers-promotion-booklet-2022.pdf (Accessed 15 June 2023).

Sonoda, M., Takano, M., Miyahara, J. and Kato, H. 1983. Computed radiography utilizing scanning laser stimulated luminescence. *Radiology,* 148(3): 833-838. (Online). Available: https://doi.org/10.1148/radiology.148.3.6878707 (Accessed 23 April 2023).

Sorsa, M.A., Kiikkala, I. and Åstedt-Kurki, P. 2015. Bracketing as a skill in conducting unstructured qualitative interviews. *Nurse Res,* 22(4): 8-12. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/25783146/ (Accessed 12 February 2023).

Sousa, C. and Veronese, G. "No safe place": Applying the transactional stress and coping model to active warfare. *Psychol Trauma*, 14(4): 558-567. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/33749297/ (Accessed 23 February 2023).

South African National Department of Health. 2020a. *Statement on Health Care Workers that have Acquired COVID-19.* (Online). Available: https://storage.googleapis.com/stateless-bhekisisa-website/wordpress-uploads/2020/08/fda38e56-hcw-13-august-2020.pdf (Accessed 19 August 2020).

South African National Department of Health. 2020b. *Coronavirus.* (Online). Available: http://www.health.gov.za (Accessed 22 June 2020).

South African National Department of Health. 2020c. *COVID-19/Novel Coronavirus: Isolating at home after testing positive for COVID-19.* (Online). Available: https://www.gov.za/covid-19/individuals-and-households/isolating-home-after-testing-positive-covid-19 (Accessed 22 June 2021).

South African Department of Health Directorate: Radiation Control (SADHD: RC). 2016. *Code of Practice for Users of Medical X-Ray Equipment.* (Online). Available: https://www.sahpra.org.za/wp-content/uploads/2020/01/Code-of-

practice-for-users-of-medical-x-ray-equipment-01-2015-2.pdf (Accessed 23 March 2023).

South African National Research Funding (NRF). 2020. *Funding.* (Online). Available: http://www.nrf.ac.za/media-room/news/covid-19-africa-rapid-grant-fund-launched (Accessed 16 May 2020).

South African Nursing Council (SANC). 2019. *SANC* distribution stats – 2019. (Online). Available: https://www.sanc.co.za/wp-content/uploads/2020/09/Stats-2019-1-Provincial-Distribution.pdf (Accessed 23 June 2023).

Spencer, R. 2015. *Ethics in pro bono practice.* (Online). Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2853226 (Accessed 14 June 2023).

Stats South Africa. 2023. *Stats SA releases new provincial GDP figures*. (Online). Available: https://www.statssa.gov.za/?p=16650 (Accessed 15 December 2024).

Stogiannos, N., Fotopoulos, D., Woznitza, N. and Malamateniou, C. 2020. COVID-19 in the radiology department: What radiographers need to know. *Radiography*, 26(3): 254-263. (Online). Available: https://doi.org/10.1016/j.radi.2020.05.012 (Accessed 21 December 2024).

Sun, N., Wei, L., Shi, S., Jiao, D., Song, R., Ma, L., Wang, H. and Wang, C. 2020. A qualitative study on the psychological experience of caregivers of COVID-19 patients. *American Journal of Infection Control*, 48: 592-598. (Online). Available: https://creativecommons.org/licenses/by-nc-nd/4.0/ (Accessed 10 May 2020).

Swaminathan, R., Mukundadura, B.P. and Prasad, S. 2022. Impact of enhanced personal protective equipment on the physical and mental wellbeing of healthcare workers during COVID-19. *Postgrad Med J*, 98(1157): 231-233.

(Online). Available: https://pubmed.ncbi.nlm.nih.gov/33273107/ (Accessed 23 February 2023).

Tay, Y.X., Tan, C., Huang, Y., Kwek, S.L., Wei, Y.-M. and McNulty, J. 2021. Get comfortable with being uncomfortable: Experiences from diagnostic radiographers a year into the COVID-19 pandemic. *Journal of Medical Imaging and Radiation Sciences*, 52(3): 332-339. (Online). Available: https://doi.org/10.1016/j.jmir.2021.05.003 (Accessed 28 October 2024).

Taylor, J.S. 2017. *Encyclopedia Britannica: Autonomy.* (Online). Available: https://www.britannica.com/topic/autonomy (Accessed 14 June 2023).

Taylor, S. and Manara, A.R. 2021. X-ray checks of NG tube position: a case for guided tube placement. *Br J Radiol*, 94(1124): 1-6. (Online). Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8764929/#:~:text=A%20chest%20X%2Dray%20taken,standard'%20in%20terms%20of%20safety (Accessed 23 January 2023).

Tesini, B. 2022. *COVID-19.* (Online). Available: https://www.msdmanuals.com/en-gb/professional/infectious-diseases/covid-19/covid-19 (Accessed 23 February 2023).

Thambura, J. and Amusa, L.O. 2016. Factors impacting on radiographers' emigration and career exiting in KwaZulu-Natal, South Africa. *African Journal for Physical Activity and Health Sciences*, 22(1): 98-107. Available: https://www.ajol.info/index.php/ajpherd/article/view/146651 (Accessed 21 December 2024).

The Nuremberg Code (1947) In: *Mitscherlich A, Mielke F. Doctors of infamy: the story of the Nazi medical crimes*. New York: Schuman, 1949: xxiii-xxv. (Online). Available: https://www.cirp.org/library/ethics/nuremberg/ (Accessed 14 June 2023).

Thomas, L. 2018. *Digital radiography versus computed radiography.* (Online). Available: https://www.news-medical.net/health/Digital-Radiography-versus-Computed-Radiography.aspx (Accessed 15 June 2023).

Toh, V., Reed, W. and Robinson, J. 2007. An investigation into the perceptions of radiographers in the Greater Sydney metropolitan area on performing intravenous contrast media administration. *The Radiographer*, 54(3): 9-15. (Online). Available: https://doi.org/10.1002/j.2051-3909.2007.tb00070.x (Accessed 23 June 2023).

Ugwu, A.C., Ahamefule, K.N. and Nwobi, I.C. 2008. Radiographers' experiences of stress and methods of coping: a content analytic phenomenologic study. *The Radiographer*, 55(1): 25-29. (Online). Available: http://doi.org/10.1002/j.2051-3909.2008.tb00080.x (Accessed 13 May 2020).

University of Southern California (USC) 2022. *Organizing your social sciences research paper: Theoretical framework.* (Online). Available: https://libguides.usc.edu/writingguide/theoreticalframework- (Accessed 14 January 2023).

University of Toronto Libraries (UTL). 2023. *Searching the literature: A Guide to Comprehensive Searching in the Health Sciences.* (Online). Available: https://guides.library.utoronto.ca/c.php?g=577919&p=4304403 (Accessed 11 March 2023).

United States Food and Drug Administration (US FDA). 2017. *What are the radiation risks from CT?* (Online). Available: https://www.fda.gov/radiation-emitting-products/medical-x-ray-imaging/what-are-radiation-risks-ct (Accessed 23 February 2023).

Uprety, L.P. 2010. Qualitative data collection, analysis and presentation: A theoretical overview. *Dhaulagiri Journal of Sociology and Anthropology*, 3: 83-

122. (Online). Available: https://doi.org/10.3126/dsaj.v3i0.2782 (Accessed 24 June 2020).

van de Venter, R., Williams, R., Stindt, C. and ten Ham-Baloyi, W. Coronavirus-related anxiety and fear among South African diagnostic radiographers working in the clinical setting during the pandemic. *Journal of Medical Imaging and Radiation Sciences*, 52(4): 586-594. (Online). Available: https://doi.org/10.1016/j.jmir.2021.09.016 (Accessed 22 January 2022).

Vijayamohan, P. 2023. *Purposive sampling 101: Definition, types, and examples.* (Blog) (Online). Available: https://surveysparrow.com/blog/purposive-sampling/ (Accessed 12 February 2023).

Walker, L.O. and Avant, K.C. 2011. *Strategies for theory construction in Nursing*. 5th edition. New York: Pearson Education.

Wapner, J. 2020. Covid-19: Medical expenses leave many Americans deep in debt. *BMJ,* 370: 1-2. (Online). Available: https://www.bmj.com/content/370/bmj.m3097 (Accessed 23 April 2023).

Weick, K., Sutcliffe, K. M., and Obstfeld, D. 2005. Organising and the process of sensemaking. *Organization Science*, 16(4): 409-421. (Online). Available: https://doi.org/10.1287/orsc.1050.0133 (Accessed 13 August 2023).

Wellness Council of America (WELCOA). 2022. *The Benefits of Stress Management for Employees.* (Online). Available: https://www.welcoa.org/blog/benefits-stress-management-employees/#:~:text=As%20is%20highlighted%20in%20an%20article%20by%20Farleigh,compensation%205%20Medical%20insurance%20%26%20other%20stress-related%20expenses (Accessed 09 January 2023).

Wishnia, J. and Goudge, J. 2020. Impact of financial management centralisation in a health system under austerity: a qualitative study from South Africa. *BMJ Global Health*, 5(10): e003524. (Online). Available: https://doi.org/10.1136/bmjgh-2020-003524 (Accessed 14 November 2024).

Wishnia, J., Strugnell, D., Smith, A. and Ranchod, S. 2019. *The supply of and need for medical specialists in South Africa*. Cape Town: Percept.

Wisker, G. 2008. *The postgraduate research handbook*. 2nd ed. Basingstoke: Palgrave McMillan.

Wisker G. 2009. *The undergraduate research handbook*. London: Palgrave Macmillan.

Wisker, G. 2019. *The Undergraduate Research Handbook*. 2nd ed. London: Red Globe Press.

Woerner, A., Forris, J., Monroe, E.J., Ingraham, C.R., Keith Ranny Pereira, Lee, E., Hage, A.N., Makary, M.S. and Shin, D.S. 2021. Interventional radiology in the coronavirus disease 2019 pandemic: Impact on practices and wellbeing. *Academic Radiology*, 28(9): 1209-1218. (Online). Available: https://doi.org/10.1016/j.acra.2021.05.025 (Accessed 27 September 2024).

World Health Organization (WHO). 2019. *WHO | Needlestick injuries*. (Online) Available: https://www.who.int/occupational_health/topics/needinjuries/en/ (Accessed 15 December 2024).

World Health Organization (WHO). 2001. *Strengthening mental health promotion. (Fact Sheet, No. 220)*. Geneva: WHO. (Online). Available: http://www.who.int/mediacentre/factsheets/fs220/en/ (Accessed 12 June 2020).

World Health Organization (WHO). 2020. *Coronavirus*. Geneva: WHO. (Online). Available: http://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/ (Accessed 20 June 2020).

World Health Organization (WHO). 2022. *Contact tracing and quarantine in the context of COVID-19: interim guidance, 6 July 2022*. (Online). Available: https://www.who.int/publications/i/item/WHO-2019-nCoV-Contact_tracing_and_quarantine-2022.1 (Accessed 15 January 2025).

World Health Organization (WHO). 2022. *Mental health. (Fact Sheet, Mental-health strengthening our response)*. Geneva: WHO. (Online). Available: https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response (Accessed 02 August 2023).

World Health Organization (WHO). 2023. *Stress.* Geneva: WHO. (Online). Available: https://www.who.int/news-room/questions-and-answers/item/stress#:~:text=Stress%20can%20be%20defined%20as,and%20threats%20in%20our%20lives. (Accessed 23 March 2023).

World Health Organization (WHO). 2023. *Value gender and equity in the global health workforce*. Geneva: WHO. (Online). Available: https://www.who.int/activities/value-gender-and-equity-in-the-global-health-workforce#:~:text=Women%20account%20for%2067%25%20of,around%205%20billion%20people%20worldwide (Accessed 23 June 2023).

Worldometer. 2020. *COVID-19 Coronavirus Pandemic (dataset).* (Online). Available: http://www.worldometers.info/coronavirus/ (Accessed 24 June 2020).

Worldometer. 2023. *COVID-19 Coronavirus Pandemic (dataset).* (Online). Available: https://www.worldometers.info/coronavirus/ (Accessed 24 March 2023).

World Medical Association. 2013. *World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects.* (Online). Available: https://www.google.co.za/url?sa=t&source=web&rct=j&url=https://www.wma.net/wp-content/uploads/2016/11/DoH-Oct2013-JAMA.pdf&ved=2ahUKEwjRoY2ZuZbfAhUC0RoKHaWICEoQFjAMegQICRAB&usg=AOvVaw3IJ5cd12oj9Tse1luMnCSu (Accessed 12 July 2020).

Xu, Z., Liu, L. and Meng, Z. 2024. What are the key factors influencing scientific data sharing? A combined application of grounded theory and fuzzy-DEMATEL approach. *Heliyon*, 10(15): p.e35034. (Online). Available: https://doi.org/10.1016/j.heliyon.2024.e35034 (Accessed 20 February 2025).

Xu, X., Yu, C., Qu, J., Zhang, L., Jiang, S., Huang, D., Chen, B., Zhang, Z., Guan, W., Ling, Z., Jiang, R., Hu, T., Ding, Y., Lin, L., Gan, Q., Luo, L., Tang, X. and Liu, J. 2020. Imaging and clinical features of patients with 2019 novel coronavirus SARS-CoV-2. *European Journal of Nuclear Medicine and Molecular Imaging*, 47(5): 1275-1280. (Online). Available: https://doi.org/10.1007/s00259-020-04735-9 (Accessed 13 December 2022).

Yasin, B., Barlow, N. and Milner, R. 2021. The impact of the Covid-19 pandemic on the mental health and work morale of Radiographers within a conventional X-ray department. *Radiography*, 27(4): 1064-1072. (Online). Available: https://doi.org/10.1016/j.radi.2021.04.008 (Accessed 14 November 2024).

Yazdani, S., Hosseini, F. and Ahmady, S. 2016. System based practice: A concept analysis. *J Adv Med Educ Prof*, 4(2):45-53. (Online). Available: https://pubmed.ncbi.nlm.nih.gov/27104198/ (Accessed 19 July 2023).

Yousef, M.O., Ayad, C.E., Elzaki, A.A.E. and Sulieman, A. 2011. Evaluation of radiology request forms in diagnostic centers in Khartoum state. *Sudan Medical Monitor*, 6(3):201-210. (Online). Available: https://www.semanticscholar.org/paper/Evaluation-of-radiology-request-forms-

in-diagnostic-Yousef-Elzaki/dc5ade8a4921a5f7286637ee58de83cf2599bbd6 (Accessed 15 February 2023).

Yu, J., Ding, N., Chen, H., Liu, X.J., He, W.J., Dai, W.C., Zhou, Z.G., Lin, F., Pu, Z.H., Li, D.F., Xu, H.J., Wang, Y.L., Zhang, H.W. and Lei, Y. 2020. Infection Control against COVID-19 in Departments of Radiology. *Academic Radiology*, 27(5):614-617. (Online). Available: https://doi.org/10.1016/j.acra.2020.03.025 (Accessed 12 January 2023).

Zanardo, M., Martini, C., Monti, C.B., Cattaneo, F., Ciaralli, C., Cornacchione, P. and Durante, S. 2020. Management of patients with suspected or confirmed COVID-19 in the radiology department. *Radiography*, 26 (2020) 264-268 (Online). Available: http://doi.org/10.1016/j.radi.2020.04.010 (Accessed 12 May 2020).

APPENDICES

Appendix 1a: University Ethics clearance

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

19 April 2021

Ms S N Hundah
25 Toledo Avenue
9 Merrivale
Bulwer
Durban
4001

Dear Ms Hundah

A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic

I am pleased to inform you that Full Approval has been granted to your proposal.

The Proposal has been allocated the following Ethical Clearance number **IREC 177/20**. Please use this number in all communication with this office.

Approval has been granted for a period of **ONE YEAR**, before the expiry of which you are required to apply for safety monitoring and annual recertification. Please use the Safety Monitoring and Annual Recertification Report form which can be found in the Standard Operating Procedures [SOP's] of the IREC. This form must be submitted to the IREC at least 3 months before the ethics approval for the study expires.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely

_____
Dr K Padayachy
Deputy Chairperson: IREC

Appendix 1b: Approval letter from the KZN Department of Health

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE:
Health Research & Knowledge Management

Physical Address: 330 Langalibalele Street, Pietermaritzburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3782
Email: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

NHRD Ref: KZ_202103_009

Dear Ms SN Hundah
(DUT)

Approval of research

1. The research proposal titled **'A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic.'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at Addington, Inkosi Albert Luthuli Central, King Edward VIII, King Dinuzulu Memorial, Prince Mshiyeni Memorial, RK Khan Hospital and Phoenix Community Health Centre.

2. You are requested to take note of the following:
   a. *All research conducted in KwaZulu-Natal must comply with government regulations relating to Covid-19. These include but are not limited to: regulations concerning social distancing, the wearing of personal protective equipment, and limitations on meetings and social gatherings.*
   b. *Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.*
   c. *Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.*
   d. *Provide an interim progress report and final report (electronic and hard copies) when your research is complete to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za*
   e. *Please note that the Department of Health shall not be held liable for any injury that occurs as a result of this study.*

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 31/03/2021

Appendix 2a: Permission Letter to eThekwini District Manager

25 Toledo Avenue
9 Merrivale
Bulwer
Durban
4001
[Date]

Mrs TB Sakyi
The Director
EThekwini Health District
Highway House
83 Jan Smuts Hughway
Mayville
Durban

Dear Madam

RE: Request for permission to conduct research

My name is Shillah Nyaradzo Hundah, a Doctor of Radiography student at the Durban University of Technology. The research I wish to conduct for my Doctoral thesis is titled: A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic.

I am hereby seeking your consent to collect research data at eight (8) of the eThekwini public hospitals and community health centres namely King Edward VIII Hospital, Inkosi Albert Luthuli Central Hospital, R.K Khan Hospital, Addington Hospital, King Dinuzulu Hospital Complex, Prince Mshiyeni Hospital, Phoenix Community Health Centre, and KwaMashu Community Health Centre. In accordance with the COVID-19 protocols, data will be collected through telephonic or online one-on-one interviews, and video-call (online) focus group discussions with the radiologists, radiographers, and nurses working in the radiology department. The participants will be expected to electronically complete a demographics questionnaire, and a consent form prior to the interviews or focus group discussions. The interviews and focus group discussions will be scheduled for a time convenient for the participants.

I have provided you with a copy of my proposal which includes copies of the data collection tool, letter of information and consent form to be used in the research process, as well as a copy of the provisional approval letter which I received from the Institutional Research Ethics Committee (IREC).

If you require any further information, please do not hesitate to contact my supervisor, Prof M.N. Sibiya and her email address is nokuthulas@dut.ac.za

Yours sincerely,

……
Ms Shillah N. Hundah
Durban University of Technology
Cell: 061 468 2660
Email: 21649783@dut4life.ac.za

Appendix 2b: Approval letter from eThekwini District Manager

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE:
Physical address: 83 King Cetshwayo Highway; Highway House; Mayville 4091
Postal Address: private Bag X 54318, Durban 4000 eThekwini District Office
Tel: 031 240 5308 Fax: 031 240 5555 Email: Ntombenhle.Ngcobo@kznhealth.gov.za
www.kznhealth.gov.za

Enquiries: Mrs. N.P Ngcobo
Date: 01/03/2021

Ms. S. N. Hundah
Durban University of Technology

RE: SUPPORT FOR RESEARCH STUDY IN "A PHENOMENOLOGICAL EXPLORATION OF THE EXPERIANCES OF FRONTLINE CAREGIVERS DURING A HEALTH CRISIS: A CASE OF RADIOLOGY DEPARTMENTS DURING THE COVID 19 PANDEMIC"

I have pleasure in informing you that the District is granting you support to conduct the research study entitled "**A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID 19 pandemic**" at eThekwini Health District facilities

Please note the following:

1. Please ensure you adhere to all the policies, procedures, protocols and guidelines of the department of health with regards to this research.
2. This research will only commence once this office has received confirmation from the provincial health research committee in the KZN department of health.
3. Please ensure this office is informed before you commence your research.
4. The District office/facility will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to the district office/facility.

Thanking you.
Sincerely,

Mrs. N.P. Ngcobo
(P, Monitoring and Evaluation Manager)
EThekwini Health District

GROWING KWAZULU-NATAL TOGETHER

Appendix 3a: Permission letter to the Head of Department of X-Ray

25 Toledo Avenue
9 Merrivale
Bulwer
Durban
4001
[Date]

Dr/Mr/Ms……**(Name of Head of Department)**
Head of Department: Radiology/X-ray
……**(Name of hospital)**
……**(Physical address)**

Dear Sir/Madam

RE: Request for permission to conduct research

My name is Shillah Nyaradzo Hundah, a Doctor of Radiography student at the Durban University of Technology. The research I wish to conduct for my Doctoral thesis is titled; a phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic.

I am hereby seeking your consent to collect research data in your department through telephonic one-on-one interviews and video-call focus group discussions with the radiologists, radiographers and nurses. The participants will be expected to complete a demographics questionnaire and a consent form prior to the interviews or focus group discussions. The interviews and focus group discussions will be scheduled for a time convenient for the participants.

I have provided you with a copy of my proposal which includes copies of the data collection tool, letter of information and consent form to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

If you require any further information, please do not hesitate to contact my supervisor, Prof M.N. Sibiya and her email address is nokuthulas@dut.ac.za

Yours sincerely,

……
Ms Shillah N. Hundah
Durban University of Technology
Cell: 061 468 2660
Email: 21649783@dut4life.ac.za

Appendix 3b: Approval letter from the Head of Department of X-Ray

Tracey Van Niekerk <Tracey.VanNiekerk@kznhealth.gov.za> Fri, Jul 30, 2021, 7:31AM

to Cibane, me

Dear Ms Hundah

Sorry for not going through everything . I just got back from sick leave and the emails have piled up.

Please send a proposed schedule for your visit/s . How long will you need with each person?

We have a staff meeting every alternate Monday . Mondays are the best because we only get started about 08h30 due to generator testing. We have the most staff on duty on a Wednesday but then we have a busy clinic .

Please let me know.

Appendix 4a: Permission letter to the Manager of the Hospital or Community Health Centre

25 Toledo Avenue
9 Merrivale
Bulwer
Durban
4001
[Date]

Name
The Chief Executive Officer/Medical Manager
Name of Hospital/Community Health Centre
Physical Address

Dear Sir/Madam

RE: Request for permission to conduct research

My name is Shillah Nyaradzo Hundah, a Doctor of Radiography student at the Durban University of Technology. The research I wish to conduct for my Doctoral thesis is titled; a phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic.

I am hereby seeking your consent to collect research data at your institution through online or telephonic one-on-one interviews and video-call focus group discussions with the radiologists, radiographers and nurses in your radiology department. The participants will be expected to complete a demographics questionnaire and a consent form prior to the interviews or focus group discussions. The interviews and focus group discussions will be scheduled for a time convenient for the participants.

I have provided you with a copy of my proposal which includes copies of the data collection tool, letter of information and consent form to be used in the research process, as well as copies of the approval letters which I received from the Institutional Research Ethics Committee (IREC), KZN Department of Health and eThekwini Health District Office.

If you require any further information, please do not hesitate to contact my supervisor, Prof M.N. Sibiya and her email address is nokuthulas@dut.ac.za

Yours sincerely,

……
Ms Shillah N. Hundah
Durban University of Technology
Cell: 061 468 2660
Email: 21649783@dut4life.ac.za

Appendix 4b: Approval letter from the Manager of the Hospital or Community Health Centre

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE:
King Dinuzulu Hospital Complex

P.O. Dormerton, Sydenham, 4015
75 R.D. Naidu Drive, Sydenham, 4015
Tel: 031 2426000 Fax: 031 2099586

Enquires: Dr Z. Dlamini

10/06/2021

Dear Ms S. Hundah

RE: PERMISSION TO CONDUCT RESEARCH – A PHENOMENOLOGICAL EXPLORATION OF THE EXPERIENCE OF FRONTLINE CAREGIVERS DURING A HEALTH CRISIS: A CASE ANALYSIS OF RADIOLOGY DEPARTMENTS DURING THE COVID-19 PANDEMIC

I have pleasure in informing you that permission to conduct the above study has been supported by King Dinuzulu Hospital Complex.

Please note the following:

1. Please ensure that you adhere to all policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. Neither the District Office nor KDHC will provide any resources for this research.
3. Your attention is drawn to the maintenance of confidentiality with respect to staff records/files and may not be removed from this Institution.
4. You will be expected to provide feedback on your findings to KDHC.

Yours sincerely

_____

Dr Z. Dlamini
Acting C.E.O.

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

OFFICE OF THE HOSPITAL CEO
KING EDWARD VIII HOSPITAL

Private Bag X02, CONGELLA, 4013
Corner of Rick Turner (Francois Road) & Sydney Road
Tel: 031-3603854, Fax:031-2061457, Email: wendy.madondo@kznhealth.gov.za
www.kznhealth.gov.za

Ref.: KE 2/7/1/ (05/2019
Enq.: Miss W.C. Madondo
Research Programming

7 May 2021

Ms S.N. Hundah
Student number : 21649783
Durban University of Technology

Dear Ms S.N. Hundah

Protocol: " A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a vase analysis of radiology departments during the COVID-19 pandemic"

Your request to conduct research at King Edward VIII Hospital has been approved.

Please ensure the following:

- That King Edward VIII Hospital receives full acknowledgment in the study on all publications and reports and also kindly present a copy of the publication or report on completion.

Before commencement:

* Discuss your research project with our relevant Clinical Head/Assistant Nursing Manager
* Sign an indemnity form at Room8, CEO's Complex, Admin. Block.

The Management of King Edward VIII Hospital reserves the right to terminate the permission for the study should circumstances so dictate.

Yours faithfully

SUPPORTED/NOT SUPPORTED

DR. N. KHUZWAYO **DATE**
ACTING MEDICAL MANAGER

Growing Kwa-Zulu Natal Together

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address : R.K. Khan Circle
Physical Address : CHATSWORTH
Tel: [031] 4596001 Fax:[031] 4011247 Email:Dianne.naicker@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:
R.K. KHAN HOSPITAL
OFFICE OF THE SENIOR
MANAGER: MEDICAL SERVICES

ENQUIRIES: DR B.S. MADLALA

21 APRIL 2021

Ms. Shillah Hundah
Durban University of technology
Student Number 21649783

Dear Ms. Hundah

RE: PERMISSION TO CONDUCT RESEARCH: A PHENOMENOLOGICAL EXPLORATION OF THE EXPERIENCES OF FRONTLINE CAREGIVERS DURING A HEALTH CRISIS: A CASE ANALYSIS OF RADIOLOGY DEPARTMENTS DURING THE COVID-19 PANDEMIC

Permission is granted to conduct the study at this institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures protocols and guidelines of the Institution with regards to this research.
2. Please ensure this office is informed before you commence your research and your University's Ethics approval must be attached.
3. **You will be expected to provide feedback on your findings to this institution.**
4. You will be liaising with: Mr Selvam Pillay
   Radiography Manager
   Tel: 031-4596130

~~Yours faithfully~~

DR B.S. MADLALA
SENIOR MANAGER: MEDICAL SERVICES

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE:
King Dinuzulu Hospital Complex

P.O. Dormerton, Sydenham, 4015
75 R.D. Naidu Drive, Sydenham, 4015
Tel: 031 2426000 Fax: 031 2099586

Enquires: Dr Z. Dlamini

10/06/2021

Dear Ms S. Hundah

RE: PERMISSION TO CONDUCT RESEARCH – A PHENOMENOLOGICAL EXPLORATION OF THE EXPERIENCE OF FRONTLINE CAREGIVERS DURING A HEALTH CRISIS: A CASE ANALYSIS OF RADIOLOGY DEPARTMENTS DURING THE COVID-19 PANDEMIC

I have pleasure in informing you that permission to conduct the above study has been supported by King Dinuzulu Hospital Complex.

Please note the following:

1. Please ensure that you adhere to all policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. Neither the District Office nor KDHC will provide any resources for this research.
3. Your attention is drawn to the maintenance of confidentiality with respect to staff records/files and may not be removed from this Institution.
4. You will be expected to provide feedback on your findings to KDHC.

Yours sincerely

Dr Z. Dlamini
Acting C.E.O.

Appendix 5: Letter of information for the participants

Title of the Research Study: A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic.

Principal investigator/researcher: Ms Shillah N. Hundah, MHSc. Radiography; BSc (Hons) Diagnostic Radiography; PG Cert. Computed Tomography.

Co-Investigator/supervisor: Prof. M.N. Sibiya, D Tech: Nursing.

Brief Introduction and Purpose of the Study: Good day. I am a PhD student at DUT doing research for my Doctorate degree in Radiography. I would like to invite you to participate in the research study fully described below. Research is a systematic search or enquiry for generalized new knowledge.

Globally, 1 in 10 health caregivers contract nosocomial infections whilst on duty. Moreover, an annual record of 66 000 hepatitis B virus (HBV), 16 000 hepatitis C virus (HCV) and 1000 human immunodeficiency virus (HIV) infections has been reported globally. In South Africa, frontline caregivers have a record of six times more hospital admissions for the management of extensively drug-resistant tuberculosis (XDR TB) compared to non-healthcare workers. As frontline health workers, radiology caregivers are at risk of nosocomial infections which are exacerbated during health crises such as the current COVID-19 pandemic. To date approximately 10% of the COVID-19 cases globally are among health caregivers. Health crises have also been associated with aggravated occupational stress levels which negatively impact on work competence. However, no known study has examined the unique experiences of radiology frontline caregivers during the COVID-19 pandemic and the resultant perceived influence of COVID-19 on their mental health.

This study therefore intends to explore the experiences of frontline radiology caregivers during the COVID-19 pandemic, in order to determine the perceived influence of COVID-19 on their mental health and provide practical recommendations through development of an evidence-based framework to support mental health coping. The study's outcome could be adopted by relevant departments to improve on staff mental wellness and coping abilities during health crises. Resultantly, standards of radiological images, diagnosis and patience care will be maintained.

Outline of the Procedures: Your role in this study is to share your perceptions and experiences in your radiology department during the COVID-19 pandemic. The data will be collected through use of semi-structured one-on-one interviews and focus group discussions. Upon accepting the invitation to participate in this study, an anonymous code will be allocated to you. You will be expected to complete a demographics questionnaire and a consent form prior to the interview or focus group discussion. The researcher will contact you to make arrangements. The interviews will be conducted telephonically or online (Microsoft Teams or Zoom), and the focus group discussions will be conducted through video calls on WhatsApp, Microsoft Teams or Zoom. These will be recorded upon your consent. The one-on-one interviews will take approximately 1 hour whilst the focus group discussions will take approximately 1 hour 15 minutes to conduct. This will occur at a time that is convenient for you. The information derived from the interviews and focus group discussions will be analysed by the researcher and made available to your departments. The study's outcome can be used by involved departments to improve on staff mental wellness and coping abilities during health crises.

Risks or Discomforts to the Participant: There are no risks involved in this study.

Reason/s why the Participant May Be Withdrawn from the Study: You may withdraw from the study at any time with no explanation to the reasons thereof. There will be no adverse consequences for those individuals who wish to withdraw from the study at any stage.

Benefits: The study's findings will provide a detailed insight into the experiences of South African frontline radiology caregivers during the COVID-19 pandemic. Additionally, the perceived influence of COVID-19 on their mental health will be established. These results will lead over to the development of an evidence-based conceptual framework for mental health coping mechanisms that are customised to the challenges and experiences of South African frontline caregivers in radiology settings during health crises. The study's outcome will be made available through publications and a complete doctoral thesis to help improve on staff mental wellness and coping abilities during health crises. Resultantly, standards of radiological images, diagnosis and patience care will be maintained.

Remuneration: There will be no remuneration.

Costs of the Study: There will be no monetary cost to yourself.

Confidentiality: All information will be stored safely. All data will only be accessible to the researchers concerned. There will be no invasion of your privacy. Your identity will be kept confidential.

Results: The results of the study will be available at the DUT research libraries and online viewing to the public as well as to your departments upon request. Furthermore, publications disseminating the findings from this research will be submitted to the South African Radiology Journal and any other African or international radiology journals.

Research-related Injury: Since this is not a clinical/intervention/or equivalent study a research related injury or adverse reaction to you is not expected.

Storage of all electronic and hard copies including tape recordings: The confidential primary data will be stored for five years by the researcher in a secure place, after which it will be shredded. Electronic documents will be stored in a password protected computer and hard drive for five years, after which they will be transferred to an external electronic media.

Persons to Contact in the Event of Any Queries: Please contact Ms S Hundah 061 468 2660, 21649783@dut4life.ac.za or Prof. M.N. Sibiya, nokuthulas@dut.ac.za, or Institutional Research Ethics administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support, Dr L. Linganiso on 031 373 2577 or researchdirector@dut.ac.za

Appendix 6: Consent

Full Title of the Study: A phenomenological exploration of the experiences of frontline caregivers during a health crisis: a case analysis of radiology departments during the COVID-19 pandemic.

Names of Researcher/s: Ms Shillah N. Hundah.

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Ms Shillah N. Hundah about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, Ms Shillah N. Hundah herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Ms Shillah N. Hundah	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**
_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Appendix 7: Interview guide

Participant Code:

Facility Code:

Date of interview: ……..

1. Ensure the consent form and Demographics Questionnaire (Section A) are completed separately before the interview commences.
2. Introduce study and read contents of the letter of information to individual participant.
3. Outline the aim and objectives of the study.
4. Re-assure the participant that their identity will be protected and confidentiality will be maintained.
5. Obtain individual participant's consent to record the interview and reassure them that anonymity will be ensured.
6. Provide guidance on how to speak audibly to ensure that responses are clearly recorded.
7. Advise participant that my role will be as a passive facilitator.
8. Facilitator will be asking open ended questions.
9. Interview will not last longer than one hour.

SECTION A: DEMOGRAPHIC INFORMATION

Each individual participant will complete this information before the beginning of the interview. Please do not write your name.

1. **Gender** ☐ Male ☐ Female ☐ Other (please specify): _____

2. **Age:** ☐ 18-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 and above

3. **Ethnicity:**
   ☐ Black (African) ☐ Asian (Indian) ☐ Coloured
   ☐ White ☐ Other *(please specify):* _____

4. **Highest Qualification Earned:**
   ☐ Certificate ☐ Diploma ☐ Bachelor's Degree ☐ Masters
   ☐ PhD

5. **Profession:**
   ☐ Nurse ☐ Radiographer ☐ Radiologist

6. **Position:**
   ☐ Enrolled nurse ☐ Staff nurse ☐ Professional Nurse ☐ Grade 1
   ☐ Grade 2 ☐ Grade 3 ☐ Chief Radiographer
   ☐ Radiography manager ☐ Consultant ☐ Clinical Head of radiology unit

7. **Duration in this position:**
   ☐ Less than a year ☐ 1-5 ☐ 6-10 ☐ 10-20
   ☐ 20 and above

8. **Place of employment:**
   ☐ King Edward VIII Hospital ☐ R.K Khan Hospital ☐ PMMH
   ☐ Addington Hospital ☐ IALCH ☐ KDH
   ☐ Phoenix CHC ☐ KwaMashu CHC
   ☐ Lake, Smit and Partners Incorporated
   ☐ Jackpersad and Partners Incorporated
   ☐ Dr Wedderburn-Maxwell and Partners Incorporated
   ☐ Other (please specify) _____

9. Years of service at the current place of employment:

☐ 2-5 ☐ 6-10 ☐ 11-20 ☐ 20 and above

10. Working environment:

☐ Clinical (directly in contact with COVID-19 patients).

☐ Clinical (not directly in contact with COVID-19 patients).

☐ Administrative/Clerical (directly in contact with COVID-19 patients).

☐ Administrative/Clerical (not directly in contact with COVID-19 patients).

11. Estimated number of COVID-19 patients (suspects or confirmed) that you attend to per week:

☐ None ☐ 1-10 ☐ 11-20 ☐ more than 20

SECTION B: COVID-19 EXPERIENCES

- Participants will be encouraged to elaborate further to give more in-depth explanations and insights.

- Any other probing questions following the participant's responses will be used to facilitate the discussion.

Question B1:

Please describe how it has been working in your current job during the COVID-19 crisis. (Interpersonal relationships, safety in the workplace, support from peers and support from management).

Question B2:

a) Please describe your feelings around your safety (risk of infection) in the workplace.
b) What factors (within the department) are influencing these feelings?

(Participants will be encouraged to elaborate further to give more in-depth explanations and insights).

Depending on responses above, if negative feelings:

c) Who do you think is responsible for controlling these factors?
d) What is the management's role in controlling these factors?
e) What role do you think you can play in controlling these factors?

Question B3:

a) How have your professional duties been impacted by working during the COVID-19 crisis?
b) What factors are influencing this impact?
c) Who do you think is responsible for each mentioned factor?
d) Who do you think is responsible for:
   i) maintaining this if there has been a positive impact on your duties.

or

   ii) minimising this if there has been a negative impact on your duties.
e) What role does management play in either of the issues above (i or ii)?
f) What role do you think you can play in either of the issues above (i or ii)?

Question B4:

a) What implications has working within a COVID-19 environment had on your health?
b) What factors are influencing these implications?
c) Who is responsible for these factors?
d) How have you dealt with each of the impacts on your health?
e) What are the perceived benefits/outcomes of your coping efforts?
f) Please describe the support you are receiving from management with regards to dealing with these impacts.
g) What factors do you believe act as barriers to your efforts of dealing with these impacts?
h) Who is responsible for resolving these barriers?
i) What is the role of the management in resolving these barriers?
j) What role do you think you can play in resolving these barriers?

THE END

Appendix 8: Focus group discussion guide

DATE: _____

1. Ensure the consent form and Demographics Questionnaire (Section A) are completed separately by all the participants before the focus group discussion commences.
2. Introduce study and read contents of the letter of information to the focus group participants.
3. Outline the aim and objectives of the study.
4. Re-assure the participants that their identity will be protected and confidentiality will be maintained.
5. Obtain individual participant's consent to record the interview and reassure them that anonymity will be ensured.
6. Provide guidance on how to speak audibly to ensure that responses are clearly recorded.
7. Advise participants that my role will be as a passive facilitator.
8. Facilitator will be asking open ended questions.
9. The focus group discussion will not last longer than 1 hour 15 minutes.

SECTION A: DEMOGRAPHIC INFORMATION

Each individual participant will complete this information separately before the beginning of the focus group discussion. Please do not write your name.

1. **Gender** ☐ Male ☐ Female ☐ Other (please specify): _____

2. **Age:** ☐ 18-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 and above

3. **Ethnicity:**

☐ Black (African) ☐ Asian (Indian) ☐ Coloured

☐ White ☐ Other *(please specify):* _____

4. **Highest Qualification Earned:**

☐ Certificate ☐ Diploma ☐ Bachelor's Degree ☐ Masters

☐ PhD

5. **Profession:**

☐ Nurse ☐ Radiographer ☐ Radiologist

6. **Position:**

☐ Enrolled nurse ☐ Staff nurse ☐ Professional Nurse ☐ Grade 1

☐ Grade 2 ☐ Grade 3 ☐ Chief Radiographer

☐ Radiography manager ☐ Consultant ☐ Clinical Head of radiology unit

7. **Duration in this position:**

☐ Less than a year ☐ 1-5 ☐ 6-10 ☐ 10-20

☐ 20 and above

8. Place of employment:

☐ King Edward VIII Hospital ☐ R.K Khan Hospital ☐ PMMH

☐ Addington Hospital ☐ IALCH ☐ KDH

☐ Phoenix CHC ☐ KwaMashu CHC

☐ Lake, Smit and Partners Incorporated

☐ Jackpersad and Partners Incorporated

☐ Dr Wedderburn-Maxwell and Partners Incorporated

☐ Other (please specify) _____

9. Years of service at the current place of employment:

☐ 2-5 ☐ 6-10 ☐ 11-20 ☐ 20 and above

10. Working environment:

☐ Clinical (directly in contact with COVID-19 patients).

☐ Clinical (not directly in contact with COVID-19 patients).

☐ Administrative/Clerical (directly in contact with COVID-19 patients).h

☐ Administrative/Clerical (not directly in contact with COVID-19 patients).

11. Estimated number of COVID-19 patients (suspects or confirmed) that you attend to per week:

☐ None ☐ 1-10 ☐ 11-20 ☐ more than 20

SECTION B: COVID-19 EXPERIENCES

- Participants will be encouraged to elaborate further to give more in-depth explanations and insights.

- Any other probing questions following the participants' responses will be used to facilitate the discussion.

Question B1:

Please describe how it has been working in your current job during the COVID-19 crisis. (Interpersonal relationships, safety in the workplace, support from peers and support from management).

Question B2:

a) Please describe your feelings around your safety (risk of infection) in the workplace.
b) What factors (within the department) are influencing these feelings?

(Participants will be encouraged to elaborate further to give more in-depth explanations and insights).

Depending on responses above, if negative feelings:

c) Who do you think is responsible for controlling these factors?
d) What is the management's role in controlling these factors?
e) What role do you think you can play in controlling these factors?

Question B3:

a) How have your professional duties been impacted by working during the COVID-19 crisis?
b) What factors are influencing this impact?
c) Who do you think is responsible for each mentioned factor?
d) Who do you think is responsible for:
    iii) maintaining this if there has been a positive impact on your duties.

or

    iv) minimising this if there has been a negative impact on your duties.
e) What role does management play in either of the issues above (i or ii)?
f) What role do you think you can play in either of the issues above (i or ii)?

Question B4:

a) What implications has working within a COVID-19 environment had on your health?
b) What factors are influencing these implications?
c) Who is responsible for these factors?
d) How have you dealt with each of the impacts on your health?
e) What are the perceived benefits/outcomes of your coping efforts?
f) Please describe the support you are receiving from management with regards to dealing with these impacts.
g) What factors do you believe act as barriers to your efforts of dealing with these impacts?
h) Who is responsible for resolving these barriers?
i) What is the role of the management in resolving these barriers?
j) What role do you think you can play in resolving these barriers?

THE END

Appendix 9: Interview/focus group preferences

Name of radiology department:

Name and Surname	Contact number	Email address	Profession	Preference: Focus group discussion (F) or one-on-one interview (O)?	Preferred platform for online video interviewing. (MS teams, Zoom, Skype or Other, please specify)	Preferred time of interviewing.

Appendix 10: Reflective log

Reflective log

TMSC - Transactional model of stress and coping HBM – Health belief model AT – Attribution theory

Participant code	Gender	Ethnicity	Date participant's transcript was cleaned	Researcher's thoughts (Researcher's reviews) on the participant's transcript	Ideas that stand out in the transcript (Thinking process)	Statements contributing to semantic/latent codes/themes	Theoretical frameworks used to explain individual differences in experiences (theories)	General comments

Appendix 11: Letter of information for Delphi survey participants

Full Title of the Research Study: A phenomenological exploration of the experiences of frontline caregivers during a health crisis: A case analysis of radiology departments during the COVID-19 pandemic.

Principal investigator/researcher: Ms Shillah N. Hundah.

Co-Investigators/supervisors: Prof. M.N. Sibiya (Supervisor) and Dr T.E. Khoza (Co-supervisor).

Brief Introduction and Purpose of the Study: Good day. I am a PhD student at DUT for my Doctorate degree in Radiography. I would like to invite you to participate in a Delphi survey to evaluate a framework emanating from the study findings and aimed to support frontline radiology caregivers in addressing mental health challenges during a health crisis. The framework presentation session is scheduled for **Tuesday, 8th August 2023**, **14h00-14h30 (SAST)** on **Microsoft Teams**. A meeting link will be shared with you.

Outline of the Procedures: Your role in this study is to evaluate the framework by providing written responses on the framework evaluation form and participating in a follow-up group discussion. Upon accepting the invitation to participate in this study, you will be expected to complete a consent form prior to the framework presentation/evaluation session. The session will be recorded upon your consent.

Links to both forms can be found on the last page of this document.

Risks or Discomforts to the Participant: There are no risks involved in this study.

Reason/s why the Participant May Be Withdrawn from the Study: You may withdraw from the study at any time with no explanation to the reasons thereof. There will be no adverse consequences for those individuals who wish to withdraw from the study at any stage.

Benefits: There are no direct benefits to yourself. However, the evaluation will assist with validation of the framework aimed to support frontline radiology caregivers in addressing mental health challenges during a health crisis.

Remuneration: There will be no remuneration.

Costs of the Study: There will be no monetary cost to yourself.

Confidentiality: All information will be stored safely. All data will only be accessible to the researchers concerned. There will be no invasion of your privacy. Your identity will be kept confidential.

Results: The results of the study will be available at the DUT research libraries and online viewing to the public as well as to yourselves upon request. Furthermore, findings may be disseminated via journal publications.

Research-related Injury: Since this is not a clinical/intervention/or equivalent study a research related injury or adverse reaction to you is not expected.

Storage of all electronic and hard copies including tape recordings: The confidential primary data will be stored by the researcher in a secure place, after which it will be shredded.

Persons to Contact in the Event of Any Queries: Please contact Ms S Hundah +27 61 468 2660, 21649783@dut4life.ac.za or Prof. M.N. Sibiya, nokuthulas@dut.ac.za, or Dr T.E. Khoza, thandokuhlek@dut.ac.za or Institutional Research Ethics administrator on +27 31-373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support, Dr V. Govender on +27 31-373 2577 or researchdirector@dut.ac.za

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LINKS TO FORMS:

- **Consent form:** **https://docs.google.com/forms/d/e/1FAIpQLSeUtRQsawMpMmw2QBvNSDJA3owJc8ZZNURvD6NWWDdtKgyIyA/viewform?usp=sf_link**

- **Framework evaluation form:** **https://docs.google.com/forms/d/e/1FAIpQLSfms-lQ8vXexzTvvNTFq4fEt6ils9VXgtjZ45l5Q2RbT_EWPQ/viewform?usp=sf_link**

Appendix 12: Consent for Delphi survey participants

Consent form

Framework evaluation session: A framework to support frontline radiology caregivers in addressing mental health challenges during a health crisis.

Name of Researcher: Shillah N. Hundah

Supervisor: Prof. M.N. Sibiya

Co-supervisor: Dr T.E. Khoza

* Indicates required question

Thank you for agreeing to participate in this framework evaluation session. Completing this consent form will take approximately 3 minutes.

Please select the appropriate box

1. I hereby confirm that I have been informed by the researcher, Ms Shillah N. Hundah, about the nature, conduct, benefits and risks of this study/session. *

Mark only one oval.

- ◯ Yes
- ◯ No

2. I have also received, read and understood the above written information (Letter of Information) regarding the study/session. *

Mark only one oval.

- ◯ Yes
- ◯ No

3. I hereby confirm that by attending this framework evaluation session, I give consent to be recorded (audio/video). *

Check all that apply.

- ☐ Yes
- ☐ No

4. I understand that I will be required to complete an online framework evaluation form. *

Mark only one oval.

- ◯ Yes
- ◯ No

5. I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report. *

Mark only one oval.

- ◯ Yes
- ◯ No

6. In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher. *

Mark only one oval.

- ◯ Yes
- ◯ No

7. I may, at any stage, without prejudice, withdraw my consent and participation in the study. *

Mark only one oval.

- ◯ Yes
- ◯ No

8. I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study. *

Mark only one oval.

- ◯ Yes
- ◯ No

9. I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me. *

Mark only one oval.

- ◯ Yes
- ◯ No

10. Please provide your name and surname. These will be kept separate from the framework evaluation responses. *

_____

Thank you for completing the form

Appendix 13: Delphi survey framework evaluation form

Framework evaluation form

A framework to support frontline radiology caregivers in addressing mental health challenges during a health crisis.

* Indicates required question

1. Please indicate your area of expertise *

Check all that apply.

- [ ] Clinical radiography/radiology
- [ ] Academia (radiography/radiology)
- [ ] Academia (other field)
- [ ] Research
- [ ] Other

2. Please indicate your years of experience in clinical radiography or radiology *

Check all that apply.

- [ ] 0
- [ ] 1-3
- [ ] 3-5
- [ ] 5-7
- [ ] 7 and above

3. Please indicate your years of experience in teaching and learning *

Check all that apply.

- [ ] 0
- [ ] 1-3
- [ ] 3-5
- [ ] 5-7
- [ ] 7 and above

Please provide brief descriptions. Questions have been adapted from Chinn and Kramer (2018: 203).

4. How clear is this framework? *

5. How simple is this framework?

6. How general is this framework? *

7. How accessible is this framework? *

8. How important is this framework? *

Thank you for participating

Appendix 14: Sample of the interview transcript

CERTIFICATE OF VERACITY

We hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

(NAME OF AUDIO RECORDING: PARTICIPANT C2D)

DATE COMPLETED	:	04/01/2022
NUMBER OF PAGES	:	10
DURATION OF INTERVIEW	:	00:28:15

NB: For this transcription, the researcher is referred to as the interviewer while the participant is the interviewee.

Interviewer: Please describe how it has been working in your current job during the COVID-19 crisis. (That is right from the beginning, when COVID-19 reached our shores until now.)

Interviewee: *Wow, initially when it came, it came in very challenging. It left almost everyone very terrified. I remember how we would be fighting among ourselves to say I will not go to the COVID-19 ward because they needed Bedside Unit (BSUs) x-rays there. So, people were saying why do we have to go; we cannot go; we will not go; we will die. If maybe there is a COVID-19 Patient Under Investigation (PUI) or maybe COVID-19 confirmed case coming down to the department for CT or x-rays, we would run away. We would not even want to come back. We would think that probably we will have this; we will have the COVID-19; but now, I think slowly we are becoming more comfortable with dealing with COVID-19 patients. I think directly because there is now more information on this infection as opposed to when it came. Initially we did not know what was going on about it. So, for now we are more comfortable, but the reality of it is that it is very exhausting. Psychologically, sometimes you feel like you just need to talk to someone, it is traumatic. Most of your colleagues are also testing positive. I was one of the people that tested positive during the second wave. So, coming back to work, going back to the COVID-19 ward, it was just not nice. It is settling slowly, but I think initially we came in very frightened. Lately we are finding our feet around it because I think we are learning to live with it in a way. However, it has been very impactful. Impactful in the sense that radiography as a profession is not really well recognized. Sometimes you will even fight for a mere mask or PPE because they say it is only given to the frontline workers. Radiographers were not being included as frontline workers since they were saying you cannot be a front worker because when a patient comes into radiology they would have already passed through a medical officer or a nurse in trauma who would have assessed and classified them as a PUI or not. So, it was really not working.* *(Theme 1: Subthemes – 1.1, 1.3; Theme 2: Subthemes – 2.1, 2.3, 2.4; Theme 3: Subthemes – 3.1, 3.2; Theme 4: Subthemes – 4.1; Theme 5: Subthemes – 5.1; Theme 6: Subthemes – 6.1)*

Interviewer: If you can please elaborate on the issue of recognition as frontline health workers with regard to PPE provision as well as the management's position?

Interviewee: Yes, radiography management has to fight and also had to make sure that we received protected clothing (PPE) but sometimes this goes beyond that because in government we are using the ordering procedure (policy) where you will find that head of departments can approve as an AD (Assistant Director) of Radiography, but this does not go straight to the Stores department. They must go through a channel of local managers. The last time I checked, they gave the Nursing Manager control over the PPE. So, there was a time when you would find that when we are ordering, the nurse manager would complain that we were ordering a lot and said we can only give you so much because you are not frontline workers because PPE is only for people working in casualty, OPD's (Outpatients' Departments) or for people elsewhere. So, that is when the Radiology manager had to step in and talk to the nurse manager to explain the type of job that we do. But honestly, it is very exhausting to always be explaining what you do while for other professions it comes easy. For example, if you are a nurse it is going to be easy for you to get protective gear (PPE). If you are a doctor you are going to get it as well but if you are a radiographer, you need to go there and explain first. (Theme 1: Subthemes – 1.3; Theme 2: Subthemes – 2.1; Theme 4: Subthemes – 4.1)

Interviewer: Please describe your feelings around your safety (risk of infection) within the workplace.

Interviewee: So, from the beginning that I mentioned earlier on, I did not feel very safe. I felt the honest truth is that you can never be too careful about infection. You know you will live in fear and always be asking yourself; did I not touch myself? Did I wash my hands very carefully? Did I wear that mask properly? Because you know what, you may have had a mask, or you might have washed your hands, but it also goes down to whether you wore your mask correctly or not. That is the reality so you will

have anxiety every time you come back home. You are not really sure about what happened when you were with the patient that you were with especially if you went to do BSUs in the particular COVID-19 ward. You will be scared to just get straight to your house. You take a shower and put your clothes outside or you soak them in water. Whatever you do, you will still have that anxiety and be asking yourself did I or did I not? But it is getting better; I will not say I feel sick now but I will say probably the level of anxiety has decreased from when COVID-19 came in to where we are currently. As a person who had COVID-19, I tested positive in the second wave, I think I am no longer much fearful of it as opposed to how I was before but when it comes to this infection I still do not feel 100% safe because you can never be too careful. That is a terrible and daunting part because you still see this patient. Some other departments will refer a patient under investigation that are possibly COVID-19 positive without letting you know and you are mix them with the normal patients in the waiting area. It is only after you check the screening forms that you realize that oh no, this is not right. So, I still do not feel safe around a developing pandemic. Yes, they now provide PPE but I still do not feel 100% safe. It is just the anxiety level that has dropped from where it was to where it is now but my honest feeling in my workplace as a front care worker is that I do not feel safe. It is very exhausting to always be asking yourself, whether you washed your hands or not. For example, I was reading over the weekend and received a call from work to advise me that the patient I did a CT scan on from this particular ward had just tested positive although the patient came in as a normal patient. Yes, I was wearing a mask but I was not geared up (donned – PPE) for that COVID-19 patient. So, now you see that even when you think you are very careful there will always be another mistake because some other people did not disclose everything. They know it is very challenging because sometimes you have to wait for two hours to clean and then close the department to ensure that we do not bring in other patients to the department following the imaging of a COVID-19 positive patient in the department. They sometimes just bring patients just like that and act like the patients are fine of which we rely on the

request form and what is written by the clinicians. So, you can never say you are safe. Our life at work is very risky and sometimes these risks are caused by our very own fellow colleagues because they do not disclose the information to you and also, the protocols in the institution may differ from one department to another. Initially when we started dealing with COVID-19, we agreed that we were going to close the department for specific hours. Reason being that our OHC (Occupational Health Committee) officer came to assess our environment and they found that we do not have a good ventilation system in place. No extractor fan, nothing. So, we were advised that when you have a COVID-19 patient, you need to clean up, close the department and wait for specific hours for fresh air to come in but now the dynamics are changing every day because most of the patients that are coming in the hospital are either PUI or confirmed COVID-19 cases and hospital management felt that closing the department is delaying patient's management. So, now it is like your life does not really matter, as long as you are there to attend to the patient. Unknowingly attending to patients that have been sent down to the department while they are under investigation or even COVID-19 positive and only realise afterwards makes it scary. It is also scary when your colleagues are testing positive because you have spent time with them. When many colleagues are testing positive, and you know that they got this infection from work because working arrangements here are sometimes not safe – the arrangements are not really that good. (Theme 1: Subthemes – 1.1, 1.3; Theme 2: Subthemes – 2.1, 2.2, 2.3, 2.4, 2.6; Theme 3: Subthemes – 3.1, 3.2; Theme 4: Subthemes – 4.1, 4.2; Theme 5: Subthemes – 5.1; Theme 6: Subthemes – 6.2, 6.3)

Interviewer: If you can please comment on the implementation of infection prevention and control protocols such as social distancing. How is that going for you as a department? (Probing question)

Interviewee: So, it depends but social distancing is a big challenge. The honest truth is that you have to be prepared to eat (take your break) when it is possible. Radiology in this particular institution gets overwhelming.

Now that we are on this lockdown level, alcohol has been opened so the trauma cases have spiked. During the day it is okay because we have three x-ray departments that are opened so you can speak to your patient properly with enough space. However, after hours or during a weekend, only one department is used and all the patients come together and you can find yourself at some point having about 86 patients waiting on one spot and our waiting area is not that massive. So, it becomes very challenging to actually adhere to social distancing directives. Also, we had one department shut down and that is the busiest department, the orthopaedics x-ray. So, all orthopaedic patients were coming down to mix with the main x-ray department patients. There are a lot of patients, so it becomes very difficult to social distance. In radiography we work in contact with patients. You cannot tell the patient, wait there, do not move, turn your legs. You need to go there and position the patient. So, the type and nature of our job makes it very difficult to say you will social distance from the patient because every patient that comes requires you to position them and you need to be in contact with them, you need to touch them, you need to turn them around for the lumbar spine x-rays. You need to be near where they are and you can only move away when you are exposing. So, it is very difficult that way. When it comes to us as colleagues, yes, we do social distance, but it is also not practical. (Theme 1: Subthemes – 1.3; Theme 2: Subthemes – 2.1, 2.2, 2.4)

Interviewer: Can you please elaborate on social distancing among colleagues? (Probing question)

Interviewee: Yes, among colleagues, it is not very practical unless you are working in two different departments or during your lunch break, you can. Because radiography is a teamwork you cannot necessarily social distance. I will give you an example with our trauma cases, the patient on a stretcher can come for full body x-rays. If you are allocated to work in trauma x-ray department with another radiographer, you are both going to be in close contact. One will be taking the cassette (Computed Radiography imaging plate) to process it while one will be bringing the

clean cassette to do the next x-ray exam and you will be helping each other to lift the patient. So, it is very difficult to talk about social distancing in that particular case. If you are working in CT scan, one will be entering the patient's details into the system; while the other one is positioning the patient and connecting the IV lines (intravenous). So, if you work in the same department at that given time, those two radiographers would not be social distancing. They are allocated to work together. If you are in the orthopaedic x-ray department there is only one room and one need to be entering the patients' details because the patients are a lot for one radiographer to do everything alone, the work will not flow. While one is entering the details, the other radiographer has to position and another can take cassettes and process them. So, we would not really talk about social distancing when working in that setting. Probably when you talk to each other during your tea break, you can social distance but not during working hours because if you are allocated to work together it is impossible to do so. (Theme 1: Subthemes – 1.3; Theme 2: Subthemes – 2.1, 2.2, 2.4)

Interviewer: You indicated the issue about the ventilation system. Can you please expand on that? (Probing question)

Interviewee: The ventilation system has not improved yet because they will need to install an extractor fan. Apparently, the department is at a stage of getting upgraded to another. They want to build another building. I do not know how true that is or how long it will take but it has not improved. One of the managers bought us a D-germ light. The D-germ light, extracts the virus quicker. So, they are mounted on the wall in the department. We have got about eight if not nine of them. So, we are hoping that that will help with the virus since the ventilation itself has not improved, it is still the same. (Theme 1: Subthemes – 1.3; Theme 2: Subthemes – 2.1, 2.4; Theme 3: Subthemes – 3.1, 3.2; Theme 4: Subthemes – 4.1)

Interviewer: Please explain your current IPC protocols for PUI or a COVID-19 positive patients coming to the department and your experiences around that. (Probing question)

Interviewee: For a PUI that is mobile we x-ray them in trauma x-ray department. Now, we do not wait since many people are coming in as PUI, because you will realize that at end of the day you have got your 120 patients that are coming for x-rays, all of them are PUIs. Splitting time will delay management of the patient like the hospital management has dictated. For general x-rays we should not wait at all. We attend to them one after the other but we clean the equipment in between them. If it is a confirmed COVID-19 patient, whether walking or very ill, they will need to be first admitted in a COVID-19 ward and they will be x-rayed there in the COVID-19 ward. There is no waiting since you just need to take in the BSU x-ray machine and cover the cassette. But if it is for a CT scan, the CT scans are booked to be done after the booked patients for the day during office hours. You will need to finish your booked list of patients first before you can call a PUI or COVID-19 patient because in CT scan, we are still adhering to closing the department for two hours after scanning a PUI or COVID-19 positive patient. However, it is shocking because when it comes to x-rays they say we should not close the department but when it comes to CT we must close. And that is one thing that we have been asking that how is the virus different, for if it is a COVID-19 suspect, what difference would it make whether it is an x-ray or a CT scan that has been done but we still have not heard anything. The challenging part is that radiographers do not take part that much in protocol development in clinical (i.e. radiographers are not involved in formulating protocols); radiologists do and in most cases I feel they use or implement these protocols when it suits them. Because in CT scan, they are present in the scan room, so they are scared that the virus might still be there and they do not want that – but, because we are radiographers you will still be involved with x-rays which they do not need to report. Nobody cares whether the virus is still in the x-ray room or not. So, that is one serious issue that we have. We have been trying to find the head of the clinical unit to address the issue. That

is the current situation at this given time. (Theme 1: Subthemes – 1.1, 1.2, 1.3; Theme 2: Subthemes – 2.1, 2.2, 2.3, 2.4; Theme 3: Subthemes – 3.1, 3.2; Theme 4: Subthemes – 4.1; Theme 6: Subthemes – 6.2, 6.3)

Interviewer: How have your professional duties been impacted by working during the COVID-19 crisis?

Interviewee: Workload has increased because many patients that are coming to the hospital now are PUIs and the cases are increasing on a daily basis. The shift has been impacted as well because we needed to design a shift where radiographers do not need to mix so as to minimize cases of cross infection among colleagues. For example, if we were all coming to work every day, if one person tested positive, chances are everyone will also test positive. They needed a shift where this group is working, the other group is not working so that we can still have another group to carry on and provide 24-hour service but that has been impacted. But job wise, it has been affected, and it is getting worse. The sad part is that radiography is not recognized. We are not recognized as front care workers. It is a challenge. Even though the workload is increasing, we are just misrepresented, or we are not really acknowledged. (Theme 1: Subthemes – 1.1, 1.3; Theme 2: Subthemes – 2.1, 2.2; Theme 4: Subthemes – 4.1, 4.2; Theme 6: Subthemes – 6.2, 6.3)

Interviewer: What implications has working within a COVID-19 environment had on your health? If there are some, please explain. (That is, all aspects of your health: physical, social, mental in relation to your work)

Interviewee: So, I will start with mental health, like I said, you always live in anxiety. You feel that you have probably contracted the virus if you have attended to a COVID-19 patient on that day. Did I wash my hands and all those questions? So, you are a little bit paranoid; hence, mentally, you are suffering from anxiety of thinking that something may have gone wrong. And then the wellbeing; I suffered one, I tested positive for COVID-19. So,

for my wellbeing as a person physically, I suffered, I got infected. It was really painful. I had more like a fever. Working within a COVID-19 environment has made me sometimes lose interest in my job in a way. We are all wishing and pushing for us to perhaps move to either academia or get a senior position where you do not attend to patients - you will just be in an office. This is because of the risk of your safety and what is happening around your life. Perhaps one can move to a different field where you will not be in contact with the patient. So, it has affected me personally on my mental state because of anxiety. Physically, I have been diagnosed with it and professionally, I am losing interest in clinical radiography on a daily basis. (Theme 1: Subthemes – 1.3; Theme 2: Subthemes – 2.1, 2.2, 2.3, 2.4; Theme 3: Subthemes – 3.1, 3.2; Theme 4: Subthemes – 4.1, 4.2; Theme 5: Subthemes – 5.1; Theme 6: Subthemes – 6.2, 6.3; Theme 7: Subtheme – 7.2)

Interviewer: How have you dealt with each of the impacts on your health?

Interviewee: The merits of the matter are you will suffer, but you have to find a way of dealing with it within yourself. For example, there is a channel in the hospital where you can go and consult and see a psychologist. We also talk amongst ourselves as colleagues. We do discuss many issues with each other and also, we have a staff clinic where, if you feel like you are tired, you cannot take it, you go and record everything. So, in the end, we use those services, but I have not consulted psychologist services yet. Mostly I talk to my colleagues about everything. (Theme 6: Subthemes – 6.1, 6.3; Theme 7: Subthemes – 7.1, 7.3, 7.4)

Interviewer: What factors do you believe act as barriers to your efforts of dealing with these impacts?

Interviewee: There is a huge barrier. For me, the biggest barrier is management because protocols that are drawn every time do not seem to have you as a radiographer in mind. Like I said we do discuss among

ourselves as colleagues, the issue why we close that department (CT scan) but not the other (x-ray). Then they (management) will change the protocol. If they close for two hours (CT scan department) and you are working there, you are safe but when you come tomorrow they change. You feel tired. You are exhausted, mentally you are not sick, mentally you are tired. You do not want to go there (you do not want to go to work), because of your fear, you call in sick. Now the management do not understand, they are on top of your case, they want sick notes. So, they are a barrier honestly this time. It is terrible for me more than anything because they are not being empathetic of challenges that are currently happening. You are a human being before you become a radiographer. You find that your partner or your mother has lost a job and that means it is a burden to you. Although one might still have a job it does not always mean that you can cover every bill that is coming out. So, there is quite a lot but you do not get the full support of people understanding the transition that this year has taken. Yes, you will still be expected to be that radiographer who will continue to perform like nothing happened. So those are the barriers, but management specifically. *(Theme 1: Subthemes – 1.1, 1.3; Theme 2: Subthemes – 2.1, 2.2, 2.4, 2.5, 2.6; Theme 4: Subthemes – 4.1, 4.2; Theme 5: Subthemes – 5.1; Theme 6: Subthemes – 6.1, 6.2, 6.3; Theme 7: Subthemes – 7.2, 7.3)*

Appendix 15: Sample of the Delphi survey framework evaluation comments

Framework evaluation form

A framework to support frontline radiology caregivers in addressing mental health challenges during a health crisis.

Please indicate your area of expertise *

- [x] Clinical radiography/radiology
- [x] Academia (radiography/radiology)
- [ ] Academia (other field)
- [ ] Research
- [ ] Other

Please indicate your years of experience in clinical radiography or radiology *

- [ ] 0
- [ ] 1-3
- [ ] 3-5
- [ ] 5-7
- [x] 7 and above

Please indicate your years of experience in teaching and learning *

- [ ] 0
- [ ] 1-3
- [ ] 3-5
- [ ] 5-7
- [x] 7 and above

Please provide brief descriptions. Questions have been adapted from Chinn and Kramer (2018: 203).

How clear is this framework? *

It is a very clear framework that can easily be used in any healthcare pandemic like COVID-19.

How simple is this framework?

The framework is simple enough for it to be used without much explanation.

How general is this framework? *

It is general enough to be used in any Radiography department and not necessarily by departments from which the participants came.

How accessible is this framework? *

The framework will be available at the DUT library once the research is completed and it is envisaged that it will also be made available through publications.

How important is this framework? *

It is a very important framework that will guide departments in times of crisis in healthcare.

Thank you for participating

Appendix 16: Letter from the professional editor

Sarah Frost

B.A. (Hons in English Literature) (UCT), Masters in English Literature (UKZN)

Editing Services

Cell: 074 384 2772

Email: sfrost@juta.co.za

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28 August 2023

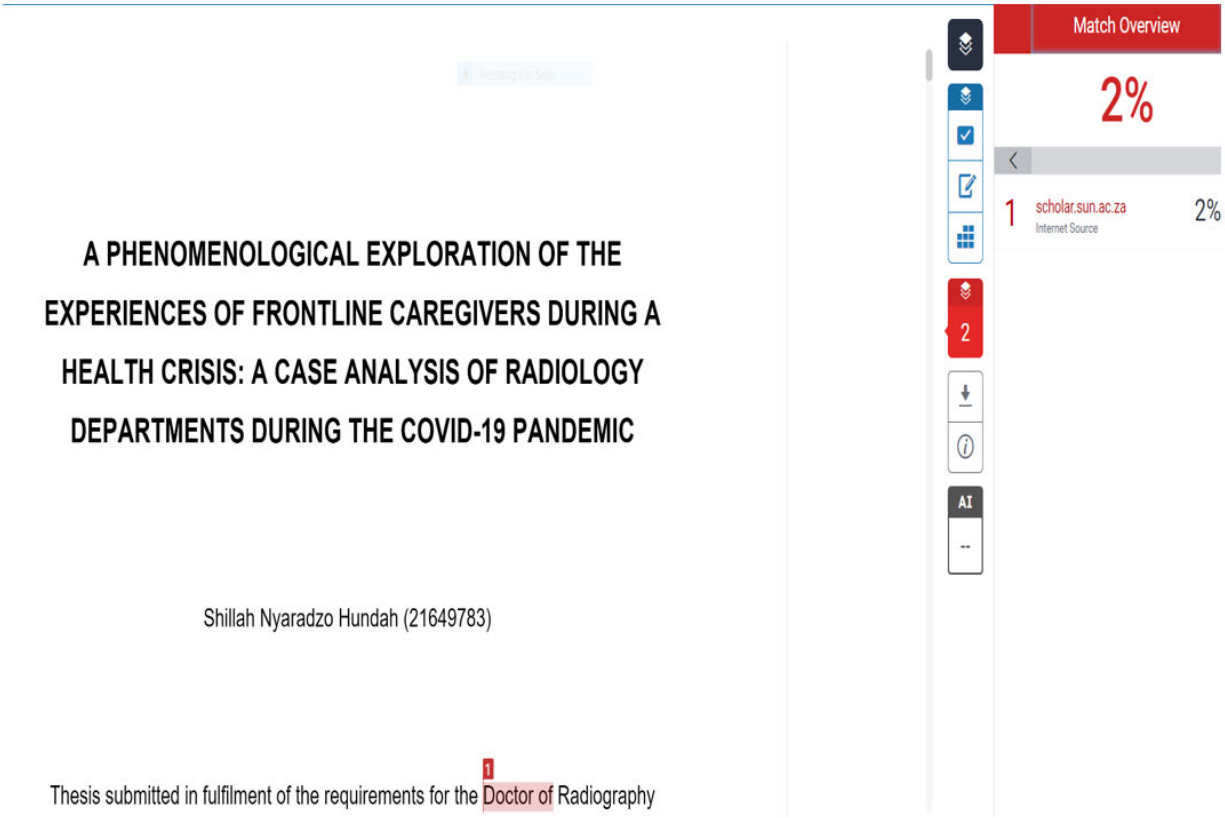
Re: Editing services rendered

Please be advised that I have edited a thesis written by Shillah Nyaradzo Hundah (21649783), submitted in fulfilment of the requirements for the Doctor of Radiography in the Faculty of Health Sciences at the Durban University of Technology. This is a thesis titled: 'A PHENOMENOLOGICAL EXPLORATION OF THE EXPERIENCES OF FRONTLINE CAREGIVERS DURING A HEALTH CRISIS: A CASE ANALYSIS OF RADIOLOGY DEPARTMENTS DURING THE COVID-19 PANDEMIC'.

Regards

Sarah Frost (Editor)

Appendix 17: Turnitin Report

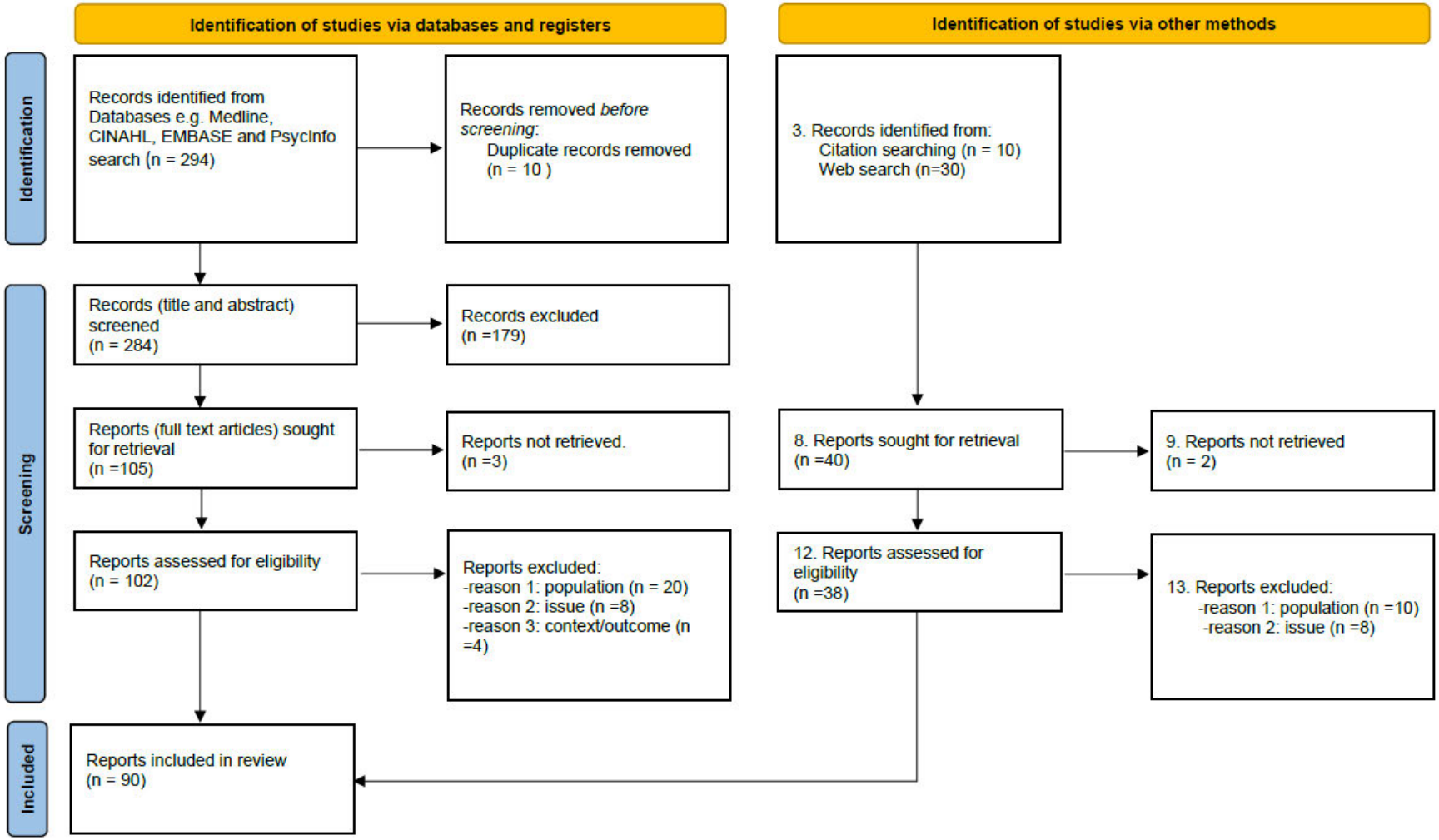


Appendix 18: Themes, sub-themes and keywords

Theme	Sub-themes	Keywords
1. Duties and roles during the COVID-19 pandemic.	1.1 Use of radiology modalities in the management of COVID-19 patients.	General x-rays. Computed Tomography (CT). Ultrasound.
	1.2 Role of radiologists.	Clinical duties and patient care.
		Radiology reporting, consultation, screening of patients and justification of radiology requests, Infection prevention and control.
	1.3 Role of radiographers.	HPCSA scope of practice. Infection prevention and control. Management. Screening x-ray request forms. Patient care and interaction. Administrative duties.
	1.4 Role of radiology nurses.	Infection prevention and control. Clinical duties and patient care.
2. Perceived personal and work-related challenges.	2.1 Unpreparedness and perceived increased risk of infection.	PPE availability. Role of management during the pandemic. Management's concern about the safety of employees. Structural deficiency of radiology departments. Increase in workload. Adhering to strict IPC guidelines. Inadequate PPE. Clinicians not sharing enough patient information.
	2.2 Adaptation to changes in systems, protocols and structures in response to the pandemic.	Booking of patients. Duties and shift rotation. Introduction of new cleaning protocols. Use of PPE. Social distancing in the workplace.
	2.3 Information about COVID -19.	Inadequate information on COVID -19 transmission. Scant information on the nature of the disease. Poor interdepartmental information sharing when caring for PUIs.
	2.4 Physical health.	Burnout due to increased workload. Back pain from carrying cassettes to the ward when doing BSUs. Contracting COVID-19. Fatigue as an after effect of contracting COVID-19. Other health-related issues.
	2.5 Financial hardships due to the pandemic.	Salary reductions. Paying out of pocket for COVID-19 related services.
	2.6 Social shielding responsibility for family members.	Taking the virus home. Desire to protect family.
	2.7 Disruption of social relations due to social distancing.	Disruption of peer-to-peer interactions. Limit on number of people in a closed space at a time. Cessation of social events. Strained interactions with family members.

3. Emotional and psychological experiences when carrying out duties.	3.1 Fear of the unknown disease.	Information about COVID -19. Prevention from COVID-19 and safety at work.
	3.2 Fear of contracting COVID -19.	Seeing people dying in large numbers in the hospitals. Anxiety and not feeling safe when attending to COVID -19 patients. Stress due to working in the midst of a serious pandemic. Emotional strain due to the fatality rate of the virus. Panic when attending to PUIs.
4. Impact on emotional well-being.	4.1 Emotional strain.	Emotional exhaustion. Colleagues contracting COVID -19. Scared of contracting COVID -19. Non-recognition.
	4.2 Mental health challenges.	Mental effects. Paranoia when attending to COVID-19 patients.
5. Impact of resultant <u>mental health status</u> on professional competence.	5.1 Attendance.	Absenteeism. Shirk work responsibilities and duties.
	5.3 Patient care and interaction.	Reduced patient contact time. Reduced interaction and communication with patients.
	5.4 Adherence to protocols.	Infection prevention and control.
6. Coping strategies.	6.1 Emotion-focused.	Accepting professional responsibilities and duties. Social coping. Appraisal-focused coping. Not taking action. Spiritual therapy. Psychological Counselling.
	6.2 Problem-focused.	Adaptive behavioural coping. Occupation-focused coping / escape-avoidance. Exercise. Solution-oriented.
	6.3 Barriers to coping	Work-related. Lack of support or recognition. Personal factors. Colleagues.
7. Intervention for mental health effects.	7.1 Emotion-based interventions.	Psychological counselling. Social interaction. Availability of spiritual support or allocation of time.
	7.2 Problem-based approaches.	Solutions.
	7.3 Support-based interventions.	Motivation and support from management. Motivation and support from team members /team work. Work-life balance.
	7.4 Availability of space or platform to vent.	Availability of space or platform to vent.

Appendix 19: PRISMA 2020 flow diagram for literature review sources



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/