UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

School of Health Care Sciences

Department of Radiography

EXPLORING THE EXPERIENCES, ATTITUDES AND KNOWLEDGE OF RADIOGRAPHERS AND FORENSIC PATHOLOGISTS REGARDING FORENSIC RADIOGRAPHY SERVICES IN LAGOS STATE, NIGERIA.

by

Kazeem Sola Sangonuga

Student number: 17395811

Dissertation submitted in fulfillment of the requirements for Master's degree in Radiography (M.Rad Diagnostic)

Supervisor: Dr. R.M. KEKANA
Co-supervisor: Dr. C. UCHE. EZE
Date: May, 2020

Researcher's contact details:
Tel: +2348032131068

E-mail:qasimajibola82@gmail.com

DECLARATION

I declare that the dissertation being submitted for the degree of Master of Radiography at the University of Pretoria is my own work. I affirm that the dissertation has not been previously submitted by me for a degree at this or any other tertiary institution. I affirm that I have referenced all the sources I have quoted in the study.

K.S

Signed

NAME: KAZEEM SOLA SANGONUGA 20/04/2020

ACKNOWLEDGEMENTS

I want to use this opportunity to thank Almighty God for sparing my life to complete this project to achieve a postgraduate qualification at the prestigious University of Pretoria, South Africa.

Words are not enough to appreciate the motherly support given by my supervisor, Dr. Mable Kekana. Thank you for your words of encouragement during our phone calls and regular emails, even when I felt like quitting.

To my co-supervisor, Dr. C. Uche Eze, many thanks for your support and valuable time devoted to the project.

To my wife, Dr. Islamiyat Sangonuga, I appreciate your words of encouragement and sacrifices during this postgraduate degree project.

I appreciate my parents and siblings for their moral and financial support. I equally appreciate my daughters' sacrifices.

And lastly to the participants who shared their experiences on forensic radiography, I appreciate you all.

ABSTRACT

Introduction

Forensic radiography is both a vital tool and a subspecialty in forensic medicine. It can be used to complement autopsy findings and reveal minor injuries overlooked during autopsy. It is also an important tool used in the identification of the dead and for establishing abuse in the living. In the United States of America, one million abuse cases are resolved annually using medical imaging. The Nigerian National Bureau of Statistics has reported a high crime rate in Lagos State and forensic radiography could be used to resolve non-accidental injury and other criminal cases.

Aim of the study

The aim of this study was to explore and describe the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services rendered in Lagos state, Nigeria. The study aimed to identify the reasons that led to radiographers being reluctant to perform forensic radiographic examinations.

Methodology

A qualitative, exploratory, and descriptive study design was used to explore the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services. The population and sampling were determined by the numbers of radiographers and forensic pathologists employed in two government-owned tertiary institutions in Lagos state. The researcher used purposive sampling to gain a deeper understanding of the real-life experiences of the participants regarding forensic radiography services in Lagos. Focus group interviews were conducted with radiographers and forensic pathologists who work in the two government-owned tertiary teaching hospitals. Participation was voluntary and consent forms were signed by all participants before the commencement of the study. The interviews were audio-recorded and later transcribed verbatim. Thematic analysis was used for the identification of codes and categories.

Results

The following themes emerged: good and bad experiences of forensic radiographers, varying inadequate knowledge of forensic radiography, different attitudes towards forensic radiography, description of radiographers' roles on forensic medicine teams, and recommendations for improvements of forensic radiography in Lagos state.

Discussion

The findings showed that in Lagos, forensic radiography was underutilized to resolve civil and criminal cases, and that there is need to improve the quality of forensic radiography services in Lagos state. Radiographers need to show more commitment in the aspect of postmortem imaging

Conclusion

It was concluded that the government should provide equipment and infrastructure for forensic radiography in Nigeria, specifically in Lagos state. Further research needs to be done to develop a curriculum in forensic radiography. Nigerian universities should introduce forensic radiography courses at undergraduate level and specialist training at postgraduate level.

Key words

Attitudes, Experiences, Forensic radiography, Forensic medicine, Knowledge, Nigeria.

LIST OF ABBREVIATIONS

Abbreviation	Meaning
BC	Before Christ
CT	Computed Tomography
DP	Dental Practitioner
FIFA	Federation of International Football Associations
IAFR	International Association of Forensic Radiographers
ISFRI	International Society for Forensic Radiology and Imaging
LASUTH	Lagos State University Teaching Hospital
LUTH	Lagos University Teaching Hospital
MRI	Magnetic Resonance Imaging
NDLEA	National Drug Law Enforcement Agency
PME	Post-Mortem Examination
UK	United Kingdom
USA	United States of America
SCoR	Society and College of Radiographers
WHO	World Health Organization

LIST OF TABLES

CHAPTER ONE: INTRODUCTION AND OVERVIEW OF THE STUDY

Modern science has made it possible to look beneath the tissues of the human body and has aided surgery in the telling of the hidden mysteries.

Tal Golan.

1.1 INTRODUCTION

Forensic radiography has become an integral part of forensic medicine that is used by forensic practitioners to supplement autopsy findings in the dead and to resolve crime cases in the living.[1] In 2012, Nigeria used forensic radiology in the identification of plane crash victims.[1] However, this is a new field in Nigeria, which faces challenges such as lack of training and dedicated equipment and the country has no standard mass fatalities plan.[1]

Radiography is the use of X-radiation to demonstrate internal structures.[1] In healthcare services, diagnostic information obtained from radiographs is used in the planning and management of different clinical conditions.[2] Radiography has also found its way into forensics since the discovery of X-rays in 1895.[2,3] Forensic radiography is a branch of forensic science and medicine that involves the use of radiography to assist in matters relating to the law.[4] It is used in post-mortem examinations (PME) by forensic pathologists to determine the manner of death, and can also be used in the identification of the deceased.[2] Forensic radiographic examinations can also be carried out on living individuals, especially in abuse cases, or to identify lesions following suspected physical abuse of a child a spouse or an elderly person.[5,6,7] In the United States of America (USA) and Australia, medical imaging has resolved one million cases of child abuse and two million cases of women who were physically assaulted by their partners.[6,8,9] Forensic radiography has also been used to diagnose fractures and patterns of injury following child abuse. It was used for the first time in a civil case after the discovery of X-rays in November 1895.[9] Judge Owen E. Lefevre of the District court of Colorado, presided over a malpractice case and became the first judge in the USA to admit a radiograph as evidence in a civil case.[9]

According to the Society of Radiographers in the United Kingdom(UK), most radiographic examinations performed on living patients could be forensic in nature.[10] Radiographers are

therefore advised by the Society and College of Radiographers (SCoR) to suspect that a living patient is a forensic case if they find vague medical histories that do not correlate with the internal lesions detected on radiographs.[1]

Obafunwa et al. have raised concerns that Nigeria appears to lag behind in the field of forensic medicine.[1] Forensic radiology was first put to the test in 2012, when 156 victims of the Dana plane crash in Lagos needed forensic imaging[1,11] Since then there have been several cases in Nigeria where forensic radiology was used to support autopsy findings.[11] Obafunwa et al.[1] reported that a radiograph was used to support the autopsy findings made by forensic pathologists in Lagos State, Nigeria. In another study conducted by Arogundade in conjunction with the National Drug Law Enforcement Agency (NDLEA), conventional X-ray and computed tomography were used in detecting illicit drug trafficking by body packers.[12] In the United Kingdom, studies have shown that radiographers who undertake forensic examinations of living subjects and cadavers were not adequately trained, did not have a good understanding of medicolegal issues and did not follow the correct procedures.[13]

Additional research has highlighted that radiographers need more training using Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) on autopsy, as is routinely done in Switzerland.[14-17] However, lack of training cannot be regarded as justification for radiographers being reluctant to perform forensic radiographic examinations.[13] According to the World Health Organization (WHO), crime is the fourth leading cause of death in the world.[18] Victims of these crime seek medical assistance from health professionals, including radiographers.[19-21] Nigeria's Lagos State has high levels of crime, as well as patients with non-fatal injuries resulting from trauma, terrorism, kidnapping and political thuggery, which are considered to be part of man-made disasters.[1] Radiographers routinely attend to patients that are victims in the above circumstances and radiographic examinations on live individuals can therefore be considered forensic in nature.[10,22] In a Nigerian study where virtual autopsy was used to resolved trauma cases, revealed minor injuries, and complemented autopsy findings by forensic pathologists that could have been missed by conventional autopsy.[23] The same authors suggested that training should be introduced for radiologists in this subspecialty of forensic radiology.[23] Due to cultural and religious sentiment, this aspect of forensic radiography could be used in lieu of conventional autopsy to assess cause of death and aid in the identification of deceased persons in Nigeria.[23] There is very little published literature on forensic radiography in Nigeria, although it is recognised that it can be used as

evidence in court to prosecute perpetrators of violence or abuse. It is therefore important that this study explores the experiences, attitudes and knowledge of radiographers and forensic pathologists so that forensic radiography services can be improved, specifically in Lagos State, Nigeria.

1.1.1 Researcher's background

The researcher is a qualified diagnostic radiographer working in a tertiary hospital since 2013. His clinical experience in radiography includes trauma and non-accidental injuries radiography. While performing radiographic examinations on living patients, the researcher also performed forensic radiography on patients that died as a result of gunshots, political violence and medical negligence. He observed that radiographers attended daily to many living patients without knowing if such X-ray examinations that were carried out fitted into the category of forensic cases. It has previously been stated that any radiography examination could be forensic in nature.[10] If a radiographer cannot distinguish between the pattern of injuries caused by abuse and those resulting from non-accidental injuries then this is potentially detrimental to the victims, who would be unable to get justice. The researcher also noted that radiographers do not know how to perform forensic radiography examinations in the living and also produce poor post-mortem images according to forensic pathologists.

1.2 PROBLEM STATEMENT

In countries like the United Kingdom and Australia, a radiographer who performs forensic imaging needs to have been trained at postgraduate level and registered with the International Association of Forensic Radiographers (IAFR) and SCoR.[10] Postgraduate training and seminar from these professional associations ensures that forensic radiographers produce diagnostic images of high technical standard. These radiographers are expected to perform examinations under robust protocols to ensure that the quality of images produced will be accepted in a court of law.[4,10] As reported by the American Society of Radiologic Technologists (ASRT), technologists in America have learnt on the job to perform forensic radiography examinations which is not recommended for graduate radiographers.[4,10] The situation is similar in Nigeria in general and Lagos State in particular because radiographers seem to perform forensic radiography by learning on the job without undergoing standardized and regulated training in forensic radiography.

During a study conducted in South Africa by Viner, it was found that some radiographers are reluctant to carry out forensic radiography examinations. Those radiographers surveyed, cited inadequate training as the main reason for their reluctance.[13] Another study found that some radiographers are not willing or not comfortable to work with dead bodies, due to psychological impact and medico-legal issues involved.[24] A study conducted by Obafunwa et al.[1] mentioned that forensic radiology was used in Lagos State, Nigeria, to identify human remains, as well as the cause and manner of death after Dana plane crash in 2012. Professional radiographers participated in the imaging of the victims of this plane crash. Nigeria is currently faced with non-accidental injuries like terrorist attacks, child abuse, body drug packers, gunshot wounds and assault cases, where forensic radiography could be useful.[1,12] In spite of the reasons cited by radiographers in other studies about inadequate education and inexperience,[10,13] radiographers and forensic pathologists in Lagos state continue to perform these examinations when requested, although they do not have specific training or qualifications. To the best of the researcher's knowledge, no study has been carried out to determine the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services in Nigeria.

1.3 RESEARCH QUESTIONS

Based on the research problem and literature review, research questions were developed to guide the methodology, data collection, data analysis and reporting in a research study.[15]
This study attempted to answer two research questions pertaining to forensic radiography services in Lagos State, Nigeria:

(i) What are the views of radiographers and forensic pathologists regarding forensic radiography services in Lagos State, Nigeria?
(ii) Why are radiographers in Lagos State, Nigeria reluctant to perform forensic radiographic examinations?

1.4 RESEARCH AIMS AND OBJECTIVES

As defined in the literature, the aim of a study is the goal the researcher wishes to achieve through a study project.[15] The aim of this study was to explore and describe the views of radiographers and forensic pathologists in Lagos State, Nigeria, regarding forensic radiography services and to explore the perceptions of radiographers regarding forensic

examinations when requests are made by referring forensic pathologists. Based on the outcome of this study, recommendations could be provided to relevant authorities on challenges faced by radiographers when performing forensic radiographic examinations.

Research objectives are used to direct a study and achieve the results of the study.[25] Two objectives were identified for this study, namely:

(i) To explore the experiences, attitudes and knowledge of radiographers and forensic pathologists in Lagos state, Nigeria regarding forensic radiography services; and
(ii) To describe whether radiographers are reluctant to perform forensic radiography services in Lagos state, Nigeria.

1.5 RATIONALE OF THE STUDY

The rationale of a study can be defined as the reason for researchers carrying out a study and the benefit of the study to the society.[25] Virtual autopsy uses cross-sectional imaging, photogrammetry, radiography, robotic tissue sampling and is a technique where cadavers are not physically opened. It could thus become the gold standard for cultures and religions where conventional autopsy is not allowed.[23] Studies conducted in Nigeria and elsewhere in the world have made it clear that forensic radiography services are needed. It is therefore important that radiographers are not reluctant to perform forensic radiographic examinations.[1,6,8]

1.6 SIGNIFICANCE OF THE RESEARCH STUDY

It is hoped that this study will highlight the state of forensic radiography in Nigeria and what is needed to improve upon forensic radiography in the country. It is envisaged that this study will provide data that will convince education and health policy makers to see the need to come up with policy towards development of forensic radiography training in Nigeria.
It is equally hoped that this study will stimulate radiographers in Nigeria to start seeing forensic radiography as a viable career option.

1.7 DEFINITION OF KEY TERMS AND CONCEPT CLARIFICATION

Key terms/words/phrases are used by the researcher to search for words in research databases or search engines. These words attract readers to the study.[25]

The key words of this study are defined as follow:

(a) **Attitude**: The way one thinks or feels about something. In this study, attitude refers to the thinking of radiographers and forensic pathologists on taking x-rays of the dead for forensic purposes.[26]

(b) **Experiences**: refers to the quality and value of all interactions at the time of working in a particular environment. In the context of this study, experiences denote the direct participation in forensic radiography examinations, either on dead or living individuals and the quality of the images produced for their diagnostic value.[27]

(c) **Forensic**: This word is used in different fields to detect or resolve crime-related cases. Forensics in this study was used to determine the role of radiographers in a forensic team and what they can do or perform in the resolution of crime cases.[9]

(d) **Forensic radiography**: This is the use of radiographic techniques to provide images of the internal structures of either dead or living humans, as well as the application of the science of diagnostic imaging to the law.[4]

(e) **Forensic medicine**: This refers to the application of medical knowledge and technologies in the collection of evidence to be used in a court of law. Such evidence may be collected from either living or deceased subjects, with the latter presented as either whole cadavers or as pathological specimens.[10]

(f) **Knowledge**: refers to skills acquired through education. In this study, knowledge means the way in which radiographers obtain their training, knowledge of current practices and processes involved in forensic radiography.[26]

1.8 PHILOSOPHICAL ASSUMPTIONS

Philosophical assumptions are interpretive frameworks used by qualitative researchers to guide their study.[28] Philosophical assumptions are divided into three paradigms, namely: ontology, epistemology and methodology.[30] Qualitative assumptions are defined as "the truth without verification".[29,30] In this study, the researcher used a set of assumptions to explore the experiences, attitude and knowledge of radiographers and forensic pathologists regarding

forensic radiography services in Lagos-State, Nigeria. These three paradigms are discussed in more detail below.

1.8.1 Ontological assumptions

Ontology is the nature of reality and its characteristics.[31] Ontological questions influence the researcher's ideas. The reality is that forensic radiography services are needed, and radiographers could, at all times, be expected to perform these examinations. It is possible that a radiographer in Nigeria might not be willing to do forensic radiography as there is no formal training available in this field of radiography, or for forensic professionals in Nigeria.[1] The contribution of forensic radiography to forensic medicine in the identification of the deceased and resolving criminal cases is unique both locally and globally.[32,33]

1.8.2 Epistemological assumptions

Epistemology is a theory of knowledge that examines the differences between belief and opinion.[34] It enhances the relationship between the researcher and the participants under study in gaining knowledge.[28] Radiographers are educationally trained to produce high quality radiographs with high technical standards. Assumption influences the researcher on how he or she develops a research project.[35] The assumptions mentioned below led to the rigorous research processes of this study. The epistemological assumptions in the study form the interpretive framework of radiographers and forensic pathologists with regard to their forensic radiography services.[28] If the skills of radiographers and forensic pathologists are utilised, they could be used to resolve crime cases. Forensic radiography incorporates specialised skills and knowledge that create opportunities for radiographers as well as opportunities for professional development in the field of forensic radiography.

1.8.3 Methodological assumptions

Methodological assumptions relate to how best evidence can be obtained from the study participants.[36] Methodological assumptions were used as a strategy to guide the choice of method to be used in the study.[37] Since the current study is qualitative in nature and focus group interviews were used for the collection of data, an inductive process of reasoning was followed during the analysis process. An exploratory, descriptive design was considered appropriate for this study, based on the research problem that the study was attempting to

resolve. According to Gray, Grove, Sutherland et al. researchers who value the perspectives of their participants, should also consider the importance of conducting their studies in a naturalistic environment.[38] In addition to valuing the voices of the participants, this study's researcher also avoided making inferences or showing bias, so that participants could express their views on forensic radiography services unimpeded. This enabled the researcher to dwell on the collected data to obtain an accurate interpretation of the participants' words.[39]

1.9 OVERVIEW OF THE RESEARCH METHODOLOGY

Research methodology is a process by which a study is structured and includes data gathering, analysis information, and all the steps taken by the researcher in a study.[39]
In this section, the reader is presented with an overview of the research methods used in the study. A detailed description of the activities undertaken during data collection and analysis is presented in Chapter three. Based on the research problem, the research question, the aims and objectives and the rationale and significance of the study, a qualitative, exploratory and descriptive design was found to be appropriate.

1.9.1 Overview of the qualitative research approach

In this study, the researcher intended to gain in-depth information and an understanding of the identified research problem by exploring the perspectives of radiographers and forensic pathologists regarding forensic radiography.
A qualitative research approach was found to be appropriate for the study because it could be used to gain a deeper understanding regarding forensic radiography services rendered by forensic professionals.[29] The literature reviews of previous studies on forensic radiography, medicine and odontology showed that they were mainly quantitative, with few qualitative studies.[8,10,22,40-43] In studies conducted in Nigeria, nothing is said about radiographers' experiences in forensics.[1,23] Exploratory descriptive study designs are not commonly used in the field of radiography, but are common in the field of nursing.[29,44] This design is used to explore and describe the experiences of certain individuals with regard to a given topic,[44] and enabled the researcher to explore the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services in Lagos state. Two categories of practitioners were invited to participate in this study: radiographers and forensic pathologists. In-depth information on the qualitative approach used is described in Chapter three of this dissertation. Purposive sampling is a non-probability sampling technique which is

best suited to a qualitative study, and thus was considered appropriate for this study.[29,45] Purposive sampling can be defined as the process used to select participants who have an understanding of the research problem.[38] In this study, purposive sampling was used to select participants who could give meaningful information about radiography and its applications in the study area of Lagos state, Nigeria.[38] Three focus group interviews were conducted consisting of five to eight people per group, and were used to collect data.[46] The qualitative nature of this study allowed for collection of in-depth data from participants on their experience, attitudes and knowledge regarding forensic radiography. Data collection involved three phases, which included preparation for the interviews, the interviewing, and the post interview phase. The associated ethical guidelines were considered, and these are presented in the following section.

1.10 ETHICAL CONSIDERATIONS

Ethical considerations are important for the successful conduct of scientific research.[29] They guide the researcher to follow strict ethical guidelines.[25] Under the right conditions, these ensure privacy, integrity and confidentiality; they minimize harm and maximize benefits for the study participants.[47] Accordingly, a written informed consent was signed by all the participants. (An example is included in Annexure C in this dissertation). The researcher ensured that participation in the study was voluntary.

Before commencement of the study, approval was obtained from the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria, as well as the Research Ethics Committee of participating institutions (The reference number of the approval letter is 416/2018 and a copy of the letter is attached to Annexure A and B). The researcher followed the stipulated policy of the University of Pretoria where audio tapes will be kept in the supervisor's locker for 15 years. The researcher also took into consideration the principles of bioethics in the national patients' rights charter, to ensure that all research participants would be safe during the study. These principles are justice, autonomy, beneficence, non-maleficence and respect for human dignity, as outlined below.[48]

1.10.1 Justice

Justice is the process of selecting all participants with the same method for the purpose of a research study only.[29] The selection must be done with fairness, equality and respect for the

rights of participants.[29] The researcher visited the Head of Unit of Radiology and Forensic Pathology of the participating institutions in order to clearly explain the aim of the study.

The researcher did not force any participant to partake in the study. To ensure justice, the researcher invited all radiographers and forensic pathologists working in the two government-owned teaching hospitals in Lagos state to participate. Radiographers working in these two institutions examine both forensic patients with non-accidental injuries, and cadavers associated with a suspicious death or a mass disaster. Forensic pathologists also examine individuals who passed away in a hospital. All participants were given the same care during the study.[49] The researcher respected all the views of the participants involved in the study. However, no participants were paid to participate in the study. The principle of justice refers to no discrimination and fair treatment for all. The focus group interviews were planned along the same lines. No sensitive questions were asked. All participants signed the consent form before the commencement of the study.

1.10.2 Autonomy

Autonomy is defined as the freedom of the participants to participate in a study as they wish.[48] The participants in this study were radiographers and forensic pathologists. The researcher showed respect for all participants by first explaining the aim and objectives of the study as well as their rights as participants and that their participation was voluntary and they could opt out at any time without any penalties or consequunces.[50] The researcher assured the participants that all information provided during focus group interviews was confidential and would be used only for the study.[51] Before participating in the study, the researcher gave each participant a consent form to read and sign. Participants were informed of the audio recording and their agreement to this was included in the informed consent forms signed before the focus group interviews. Privacy and confidentially were maintained during data collection and data presentation. The researcher told participants to avoid mentioning their names during the interviews. The names of the hospitals were not mentioned in any publication or presentation at conferences, and no names were used to identify participants. The recorded data was identified as focus group 1, 2, 3, and the participants were assigned numbers as Radiographer 1A, 1B, 2A, 2B. Forensic pathologists were numbered as FP 1, 2, 3. All participants were informed that there would be no sensitive questions in the focus group interviews. Data would be stored in the supervisor's locker and would remain there for 15 years.

1.10.3 Beneficence

Beneficence is defined as the process by which researchers are concerned about participants' best interest during and after the study, even if it conflicts with the researcher's interests.[29] The researcher assured participants during focus groups that the principle of benefit applied in the study.[52] The researcher also told participants that experiences and views shared would be used to improve the quality of forensic radiography services. This study was non-interventional. Even though the research might not yield direct benefits to the participants, it might be enjoyed by future generations in the field of radiography. The hospital that requested feedback to improve the quality of their forensic radiography services would be informed about the findings of the study.

1.10.4 Non-Maleficence

Non-maleficence is defined as the process by which a study must be free from harm to any participants or any institution that chooses to partake in the study.[51] The participants were not subjected to any discomfort during the interview or asked questions that can cause emotional distress. The researcher assured participants that the principle of no harm would apply in the study to ensure their privacy and confidentiality,[28] as explained in section 1.8.3. Participants' views from multiple perspectives were valued and taken into consideration. The researcher reminded the participants during the focus group interviews about the objectives of the study, which were to determine the experiences, attitude and knowledge of radiographers and forensic pathologists with regard to forensic radiography services rendered in Lagos state. The responses gained from the participants would be used to improve the quality of services rendered after the study was completed.

1.11 OUTLINE OF THE DISSERTATION CHAPTERS

Chapter one: Orientation of the study

Chapter one introduced the topic and presented an overview of forensic radiography and its applications within forensic medicine context. The problem statement, research question, research aims and objectives, rationale for the study, definition of key terms and concepts clarification are presented in this chapter. The researcher introduced philosophical assumptions because of the qualitative nature of the study design. The research methodology was briefly presented and included the sampling strategy, the study population, and that the

research design was exploratory and descriptive. Credibility, confirmability, dependability and transferability were addressed and discussed to ensure trustworthiness. Ethical principles and ethical clearance were addressed.

Chapter two: Literature review

Chapter two presents the history and research conducted on forensic radiography both in Nigeria and globally. An extensive literature review was done on the topic of forensic radiography, imaging and medicine. It was found that previous studies were reported using a quantitative study design. The researcher chose to approach the study from a qualitative point of view because in-depth information and deeper understanding of the study needed to be achieved. The gap in knowledge in the field of forensic radiography was addressed.

Chapter three: Research methodology

Chapter three gives an overview of the research process and justification as to why the researcher decided to use qualitative inquiry, which is exploratory and descriptive in nature. The details of the process that took place in the research are discussed, including the study setting, the role of the researcher and research assistant, and the instruments used in the research. The data analysis and logistics and planning involved in organising acceptable focus group interviews is presented.

Chapter Four: Results

In Chapter four, the data are analysed in detail and the results are presented both in a table and narrative format. Demographic information is provided in tables and explained in the text. The data from various focus groups is presented using codes and categories. These categories are discussed and supported by extracts from the interviews. Finally, the themes that emerged from the categories are presented.

Chapter Five: Discussion

In Chapter five, all the themes that emerged in Chapter four are discussed in tandem with the literature review. The themes are further presented in line with the study objectives, which allowed for interpretation. Following the discussion and interpretation of themes, the major research findings are presented.

Chapter Six: Conclusions, Limitations and Recommendations

In this chapter, the research findings are elaborated upon in relation to the research questions, aim and objectives. The challenges and limitations faced in the study are noted. Recommendations for future studies to develop a curriculum in forensic radiography as well as suggestions for improving the quality of forensic radiography services are made. Overall research conclusions are presented in this chapter.

1.12 CONCLUSION

In Chapter one, the researcher introduced the subject of forensic radiography as a subcategory of forensic medicine. A brief literature review was presented to underscore the research problem, and the research question and aims of the study. Situations globally and in Nigeria that impact on the delivery of forensic services were presented. The application of forensic radiography in forensic medicine was presented to address the challenges faced when delivering forensic radiography services for both the living and the dead. The advantages of using virtual forensic radiography when conventional autopsy is rejected by the family of the deceased were highlighted.

Due to the qualitative nature of the study, philosophical assumptions were also made and described in detail. Ethical principles were addressed and presented. The chapter ended with an overview of all chapters in this study.

CHAPTER TWO: LITERATURE REVIEW

Show me the manner in which a nation or community cares for its dead and I will measure, with mathematical exactness, the tender mercies of its people, their respect for the law of the land and their loyalties to high ideals.

William E. Gladstone

2.1 INTRODUCTION

Chapter one gave an overview of the study, the research problem, research question and aim and objectives of the study. The chapter also touched on the literature that showed challenges radiographers faced when delivering forensic radiography services. This chapter focuses on the literature reviewed for this study. Researchers must engage in a literature review in order to correlate the findings of previous studies with their own study.[52] A literature review involves a process where the researcher demonstrates to the reader the work that is currently taking place around the world in the field of interest and to fill any existing gaps in the knowledge.[25] This tells the reader that the researcher is conversant with what is happening globally in the field of study.

As mentioned in Chapter one, the researcher noted that previous research has mainly been reported from a quantitative stance. These quantitative studies lack in-depth exploration. The reader is reminded that this study is approached from a qualitative point of view because the experiences, attitudes and knowledge of radiographers and forensic pathologists can be explored until the data becomes saturated. Search engines and the key words of this study were used in accessing the literature, as shown below in Table 2.1.

Table 2.1 Electronic search engines and key words used to search databases literature

Electronic search engines	CINALH, Mesh, Science Direct, Medline, Wiley Online Libray, Pubmed.
Key words	Radiography, forensic medicine, forensic radiography, computed tomography, age determination, non-accidental injury, radiographers, forensic pathologists.

Based on the existing literature on forensic medicine as it is practiced in Nigeria, there is limited evidence of radiographers' participation in forensic radiography services.[1] The current study is aimed at addressing this gap. A broad overview of the importance of forensic radiography in forensic medicine is presented in the following section.

2.2 HISTORY OF FORENSIC MEDICINE AND FORENSIC RADIOGRAPHY

Forensic medicine can be traced back to ancient Egypt, with specific reference to death investigations.[53,54] In the past three decades, forensic medicine has been in public domain through television documentaries, movies and scientific literature.[54] Forensic pathology as we know it today, is the most popular aspect of forensic medicine that deals with the legal implications of death, dating back to 1850 Before Christ. Even though forensic medicine has to with the dead, modern-day forensic medicine has expanded into dealing with living patients. Forensic medicine that deals with the living has had less attention from the public compared to deceased; therefore, radiographers use their knowledge of clinical radiography to attend to living patients.[53-55] In Nigeria there is little in the literature about forensic medicine and forensic medicine professionals. Although anatomic pathologists exist in Nigeria, few have trained in forensic medicine.[1]

Forensic radiography came into the limelight immediately after the X-ray was discovered in 1895.[9] Forensic radiography is used either solely or as adjunct to forensic procedures to resolve civil and criminal cases.

2.2.1 Forensic radiography in first world countries

Forensic radiography plays a significant role in developed countries in revealing natural and unnatural deaths.[56] Based on the vital role imaging played in research conducted on the cause of an adult death in Manchester in 2008,[57] MP Jack Straw discussed in the House of Commons how autopsy imaging could effectively be used in the United Kingdom.[58] Due to complaints from the public and patients' relatives about conventional autopsy it was then integrated as part of mass fatalities and national disaster victim identification.[59-61] Thus, in most developed countries, forensic radiography is used as an adjunct or alternative to conventional autopsy.[4,84] England and Wales conduct the highest number of autopsies in the

world in which forensic radiography is used in some cases.[61,62] These developed countries are: USA, the United Kingdom, Australia, Japan, Switzerland and Germany, all of which have contributed much to post-mortem imaging.[63] USA lags behind other developed countries in forensic radiography, despite many crimes perpetrated that this imaging could resolve. There is no standardised training programme for radiographers performing forensic radiographic examinations in USA.[4] Radiographers need knowledge to testify in a Court of Law and the USA has only two institutions for forensic radiology training compared to 150 institutions in Europe,[59,64] which has the highest number of post-mortem imaging institutions.[65] Further, USA has no regulatory body that oversees the work of radiographers performing forensic radiography, because the practice of forensic radiography differs from state to state.[4,9,13] In a study conducted to search the literature on the rise of forensic and post-mortem radiology between 2000 and 2011, 661 publications were found to have articles on living and deceased individuals.[63] Europe led in the publications with 65%, followed by Asia 15%, America 15%, Australia 4%, and Africa lagged behind with about 1%. The search also revealed that a Virtopsy project was introduced in Switzerland during this period.[60] Switzerland has the highest publications on forensic imaging in the world. Forensic radiography is a routine part of conventional autopsy.[63,66]

2.2.2 Establishment of the international forensic radiography association

In the past three decades, imaging has played a critical role in the evaluation of living and deceased forensic victims. This has led to the establishment of the International Association of Forensic Radiographers (IAFR), the International Society of Forensic Radiology and Imaging (ISFRI), and other bodies which specialise in the field of forensic medicine.

The IAFR is an association of professionals that provides medical imaging services for the investigation of living and deceased victims. The IAFR was established in the United Kingdom in 1998 by Mark Viner, Wayne Hober, Bruno Tonello and Catherine Leons as a sub-group. The Society and College of Radiographers (SCoR), which is a registered body for all radiographers working in United Kingdom, recognises the Association of Forensic Radiographers as a specialist group in forensic radiography. Forensic response teams specifically working on disaster victim identification, were formed by the Association of Forensic Radiographers (AFR) and produced guidelines for radiographers.[5,10] In 2006 the AFR membership rose to 300. The name AFR was changed to the International Association

of Forensic Radiographers (IAFR) in 2008 because of its international recognition as a forensic radiographers' group. The mission of the association is to promote the best forensic radiography services through research and development of protocols, course curricula and guidelines for forensic radiographers.[5,10] Members of the IAFR worldwide have a clinical background in radiography and work in different fields of forensic radiography such as the living and deceased victims.[5,10] The IAFR, the SCoR, the Irish Forensic Radiography Group and the International Society of Forensic Radiology provide guidelines for radiographers on age estimation for living forensic patients, and paediatric post-mortem imaging protocols, among others. A positional statement by the ISFRI-DVI working group on the use of post-mortem computed tomography (PMCT) has produced revised guidelines for forensic radiography, guidance for providing forensic CT services, an educational framework for forensic radiography, and guidelines for best practice.[5,66] Every living forensic patient should be treated as a non-medical referral, therefore, informed consent must be obtained from the patient or from a court.[4,9]

2.2.3 Forensic Radiography in South Africa

In South Africa, a forensic radiography workshop was organised in Kwazulu Natal in 1998.[67] In 2008, the IAFR organised its first international meeting at the International Society of Radiographers and Radiological Technologists (ISRRT) conference, in conjunction with the Society of Radiographers in South Africa (SORSA) in Durban, where presentations were made on examinations performed on living and dead forensic patients.[67] The focus of the workshop included a follow-up workshop training provided for radiographers and mortuary technicians in forensic radiography examinations. It was reported in 2012 that more than 30 forensic examinations were done in the Steve Biko Academic Hospital (SBAH) in Pretoria. The imaging modality used was mainly computed tomography (CT).[67] The author goes on to raise concerns that few radiographers seem to have been exposed to forensic examinations of the dead.[67] In another South African study conducted by Mark Viner, which involved health care professionals and included the views of forensic pathologists, radiographers, anthropologists and odontologists working in the field of forensic medicine, interviews regarding forensic radiography examinations were conducted. Odontologists and anthropologists make use of X-ray examinations in the identification of the deceased.[13] Forensic pathologists use radiography in cases of road traffic accidents, homicides, and gun-shot injuries to support their autopsy findings and resolve criminal cases.[1] Some

radiographers are reluctant to conduct forensic radiography examinations on the dead, while some are keen to perform forensic radiography examinations without having had training in forensics. Radiographers receive little training during their undergraduate years, and no postgraduate training in forensic radiography.[13]

Similar situations were noted in a study conducted by Obafunwa et al. in Nigeria, where forensic pathologists used radiographs to support their autopsy findings. There is also no training given to forensic professionals such as radiographers and pathologists in Nigeria.[1]

In a South African study conducted by Vermeulen, radiographic dental implants were developed for identification of the deceased, where 384 dental implants were observed on the pantomographs.[68] Of these, 380 dental implants were identified on the pantomographs, while four dental implants could not be identified. Three hundred and fifty (350) dental implants (91%) were identified as dental implant types listed in the reference instrument, while 30 dental implants were identified as a dental implant type not listed in the reference instrument, while 208 dental implants (54.2%) could be positively identified. The radiographic dental implant guide was developed based on positive identification.[68] This guide helps radiographers to identify living and deceased forensic patients who died as a result of non-accidental injuries or during mass disaster.

In a study conducted in South Africa by Lukhozi, which reported on victims of violence such as trauma and non-accidental injuries seeking medical attention from health care providers, the study emphasised that radiographers are part of a team.[69] Most radiographic examinations are forensic in nature, therefore, radiographers should be able to recognise patterns of fractures on images and provide images of high diagnostic value to resolve such crimes in South Africa.[10]

2.2.4 Forensic radiography in Nigeria

Forensic radiography was first used in Nigeria in 2012, following Dana plane crash in Lagos State[1,11] when the service was required for identification of the 156 victims. The international standard guidelines of disaster victim identification of the deceased were observed.[70] Since then there have been several cases in Nigeria where forensic radiology was used to support autopsy findings.[11] Previous disasters in Nigeria resulting in mass casualty where forensic

radiography could have been used the gasoline explosion in Jesse in October 1998, where 500 people died and about 100 were wounded. In May 2002, there was a plane crash in Kano where 148 people on board died; 117 passengers were killed in Belleview flight 210, which crashed at Lisa village in October 2005; 108 students lost their lives in a Sosoliso airline crash in Port Harcourt in December 2005, including three children from the same parents.[71] In May 2006, 200 people died at Ilado village during pipeline vandalization by unknown individuals. There was also the ADC Airline's Boeing 737 flight 53, which crashed after takeoff at Abuja in October 2006, where 96 people died including many medical practitioners and the then Sultan of Sokoto. There were only nine survivors.[71] Another pipeline vandalization was recorded in Abule-Egba in December 2006, where more than 100 charred bodies were buried at the scene without positive identification of the deceased.[71] More recently, Boko Haram terrorist attacks in north-east Nigeria have killed thousands of Nigerians annually, with victims being laid to rest without proper identification.[71]

Forensic radiography can aids in revealing the cause of death and identification of deceased to console the bereaved.

With all these man-made and natural occurrences, victim identification is inevitable in Nigeria, in view of terrorist attacks that occur daily. However, there is also a need for post-mortem radiography as an alternative or complement to autopsy examinations.

Radiographers in Nigeria provide forensic radiography services for both living and dead victims, despite the low level of awareness on forensic radiology. Moreover, while forensic radiography and radiographers play an important role in delivering forensic radiography services in Nigeria, very little has been written about them, despite their key role in forensic medicine.

In a study conducted by Nwafor et al., Virtopsy multi-slice computed tomography (MSCT), which is part of forensic radiography in this study, was used to describe radiographic patterns of gunshot injuries to the head.[23] Virtopsy was done for the first time in Nigeria and Sub-Saharan Africa in 2018 to identify fatal injuries, minor injuries, and their cause. The study was done before conventional autopsy, without the knowledge of the forensic pathologists who conducted a conventional autopsy on the deceased. Virtual autopsy complements conventional autopsy findings and reveals minor injuries that are not seen in conventional autopsy. It can serve as alternative to conventional autopsy.[23] Nigeria is still grappling with conventional autopsy due to discrepancies in the results which can stem from inexperience of

the radiologist in the field of forensic radiography.[23] In Nigeria, forensic pathologists use conventional radiography and fluoroscopy to document fractures in areas not easily seen during a conventional autopsy.[10,23] Furthermore, radiographs have helped to locate foreign objects, detect occult injuries, and identify the deceased.[1]

Skeletal survey radiography has been shown to be useful for the rapid detection of unknown fractures and various other injuries.[16] Forensic radiography can be used to reveal the cause, manner and mechanism of death, and to search for identification items such as evidence of previous dental treatments.[17] It can be used to estimate age, as well as ante- and post-mortem radiological comparison, and to look for foreign objects in aircraft accident victims.[1,4] Radiologic examination is important for a complete assessment of an aircraft crash, and for estimating the situation of the pilot at the time of the crash.[1] The fact that forensic radiography has become a vital component of modern medical practice and significantly contributes to decision-making situations in forensic medicine and odontology, is beyond reasonable doubt. Virtual autopsies can be utilised in cultures where conventional autopsy is not tolerated for religious reasons or is rejected by family members because of invasion and supposed incompleteness of the body before burial. In terms of virtual autopsies, imaging is going to become the future gold standard of forensic examination.[11] The study's literature review gave an understanding on the development of forensic radiography services in Lagos State, Nigeria. The existing literature suggests that medical personnel should be trained in forensics related to their field of study.[10,23] Radiographers in Lagos state, Nigeria, performed forensic radiography services both on the living and deceased forensic victims; furthermore, the experiences, attitudes and knowledge of radiographers were not published in previous articles in Nigeria.

2.3 THE IMPORTANCE OF FORENSIC RADIOGRAPHY IN FORENSIC MEDICINE

In section 1.1 of the previous chapter, forensic radiography applications and their contribution to forensic medicine was discussed. Forensic radiography is a speciality in the field of forensic medicine that deals with the production of postmortem images in matters relating to the law and forensic studies can also be conducted on living individuals as well.[10,63] Forensic imaging

became a relevant topic on television during the September 11th attack on World Trade Centre, USA in 2001, the Indian Ocean Boxing day Tsunami in 2004, the London bombing in 2005, the attacks on Paris and in Belgium in 2015 and 2016, and the Grenfell Tower disaster in west London where 71 adults and children died in 2017. [72,73] The new millennium is faced with many challenges posed by terrorism, non-accidental injuries and mass disaster. Forensic radiography plays a vital role in identification without mutilation of the deceased as is done in the conventional autopsy.[33] Forensic imaging also protects the forensic team from transmission of diseases such as hepatitis and Creutzfeldt-Jakob disease.[74] Forensic radiography became important since the discovery of X-rays in 1895,[75] and has been used in medico legal cases in identification of the dead and in resolving criminal cases.[75,76] Over the past two decades, different imaging modalities have been used in the field of forensic radiography to assist, reduce the work of forensic pathologists, and serve as an alternative to conventional autopsy due to religious and cultural reasons.[24,72] Forensic radiography involves the use of imaging modalities, namely, Computed Tomography, Magnetic Resonance imaging, Conventional Radiography and dental, fluoroscopy, Lodox, nuclear medicine and ultrasound to produce diagnostic images that can be used for identification of the deceased, the abused, body packers and resolving criminal cases in living forensic victims. These imaging modalities are used by radiographers in forensic medicine to reveal minor injuries that cannot be seen in conventional autopsy.[23,32] If available they are used in place of ante- and post-mortem radiography to complement autopsy findings based on the suspected area of interest, to reveal the cause of death and in identification of the deceased during mass disasters when screening the bodies.[77] Forensic radiography have multifaceted applications in forensic medicine in both living and dead individuals such as identification, estimation of age, non-accidental injuries, body backers and medical negligence.[10,78,79] Identification is elaborated upon in the following section.

2.3.1 Identification

Together with any of the imaging modalities mentioned earlier in the preceding section, forensic radiography aids in identification of the deceased. These can be people who died due to traumatic injuries, mass disaster, individuals missing as a result of terrorism, or death from natural occurrences.[79,80] Identification of the deceased involves the use of dental radiography

for the identification of the individual; visual recognition of body characteristics like tattoos, scars, skeletal remains, fingerprints, Deoxyribonucleic acid (DNA) analysis, dental identification and radiological examinations as recommended by Disaster Victim Identification principles (DVI). Age, sex, and stature are used by forensic teams for identification of a deceased or missing individual by comparing ante- and post-mortem radiography during mass fatalities. It can also be used in living individuals to identify the trajectory of a gunshot exit.

Dental radiography is a valuable part of forensic medicine which has been used in resolving criminal cases and identification of the deceased since 1890.[81] In 1949, when the liner S. S. Noronic in the Canadian Great Lakes was consumed by fire, dental radiography was used by forensic odontologists to positively identify 24 disfigured victims of 119 who died in the disaster. As previously mentioned, it was also used for victim identification in 2004, after the Indonesian tsunami, and brought more awareness to the role of dental radiography in identification. The objectives of dental radiography are to identify individuals who suffered violent injuries and lost their lives or who were involved in a mass disaster, and to assist in identifying child abuse.[82] Forensic pathologists use ante- and post-mortem radiography in the identification of human remains and, in conjunction with other imaging modalities, to complement their autopsy findings.[83] Hence, when comparing ante- and post-mortem dental radiographs, forensic teams should take note of dental anatomy, dental implants, and number of teeth for positive identification of the deceased.[84-87] Forensic radiography has multifactorial applications in forensic medicine and serves as a reference point in medicine.[88,89] It uses different features in identification of the deceased such as gender, age estimation, uncommon pathology, the paranasal sinuses and the sella turcica.[88,89]

Forensic radiography plays a vital role in determination of gender by helping to rule out certain possibilities such as whether the remains or bones belonged to a male or female. Radiographic examination of the skull, pelvis and femora, and measurement of the scapular aid the forensic team in gender identification.[88] The gynaecoid and android pelvis also makes a clear distinction in identification. In a study conducted by Mundorff, Vidoli, Melinek, Simpson, James, Eitzen et al., forensic radiography provided details of foreign objects and long bone appearances in the bodies of deceased or `missing persons for proper identification.[88,89] This helped the forensic team to classify the deceased based on race, height and origin.[88,89]

2.4 AGE DETERMINATION

Age determination is the process by which authorities seek to establish the chronological age, or range of age, or to determine whether an individual is an adult or a child.[90] Radiology can be used to establish the age of juveniles and living and deceased individuals from 20 weeks gestation to adulthood, and degenerative changes like kyphosis can also be used to determine the age of living individuals and the deceased at time of death.[85] Radiography of the left hand and wrist can determine the age of a living individual, however, in developed countries it is prohibited to use radiation to determine the age of living individual.[5]

Forensic radiography has a great role to play in sport, for instance by guaranteeing fairness among footballers in a competition.[91] The Federation of International Football Associations (FIFA) has specified ages for both males and females participating in a tournament. A participant who is older than the specified age will get unfair advantage in the tournament due to his body size and weight.[91] In a study conducted by Dvorak et al. on age determination for footballers, Magnetic Resonance Imaging which is non-ionizing radiation, was used to estimate the ages of healthy adolescent footballers.[91] Studies were carried out on footballers between the ages of 14 and 19 years. 1.5T MRI equipment and a wrist coil were used to conduct the studies, which took place in Switzerland, Malaysia, Algeria and Argentina. In fact, it is widely believed by many Nigerians that FIFA disqualified some footballers from Nigeria in 1988 due to their age. The researcher strongly believes that FIFA must have relied on MRI results to arrive at that painful decision.

2.5 NON-ACCIDENTAL INJURY

The term non-accidental injury had been in existence since 1860 when a French physician, Ambroise Tardieu, published a study on 32 cases of non-accidental injuries.[92] In the study findings he advised physicians to be aware of non-accidental injuries whenever they suspected that the clinical findings in their patients were unusual.[92]

Non-accidental injuries can be defined as intentional injury inflicted on a child by parents or guardian.[93] Such injuries are a global issue that increases child morbidity and mortality

irrespective of country of origin, with the highest prevalence in African countries[94-96] and is the third leading cause of death in children.[94-96] In USA, it was found that 10% of children below the age of 5 years who visit hospitals are victims of abuse and 1 500 die annually as a result of non-accidental injuries.[6]

In 2015, 700,000 children in USA were affected as a result of abuse, and the majority of these victims are children below the age of one year.[97,98] Studies conducted in Britain and America show that 74.8% of children below the age of 3 years died as a result of abuse in 2013 and 2017 respectively[99,100] In an Australian study, 42,000 children were affected as a result of abuse in 2015 and 2016.[7,101] It is of great concern that children of less than two years are victims of these incidences which are reported from developed countries where records are maintained. Developing countries have their own share of non-accidental injuries, despite the lack of proper records on such incidents. It is therefore important that forensic radiography services in developing countries be improved in order to contribute to better record-keeping and reporting.

According to WHO, the lives lost as result of non-accidental injuries in developing countries in 2020 will equal those lives lost as result of infectious diseases.[101] Olatunya et al. conducted a study in south-west Nigeria to raise health care providers' awareness on the existence and reality of non-accidental injuries, of which forty-four cases were recorded in 17 months.[102] However, another Nigerian study by Anochie and Graham-Douglas, reported only 14 cases over a three year period.[103] In a Ugandan study, 15% of non- accidental injuries were recorded which is not different from the situation in Nigeria.[104] All these studies revealed the growing burden of non-accidental injuries in Nigeria and on the African continent.[101] There must be urgent awareness among health care providers to recognise non-accidental injuries as is done in the developed world. In Africa, non-accidental injuries are under-reported because perpetrators of these crimes are guilty and ashamed of their actions.[103] In USA, medical imaging is used to resolve non-accidental injuries.[9] Medical imaging plays a vital role in non-accidental injuries, however, health professionals like radiographers must be trained to recognise abuse. The victims' parents or guardians are inclined to give vague clinical histories, which lead to lack of recognition and violates the victims' rights.[105,106] Radiographers in Nigeria's Lagos state attend to many non-accidental injuries in their day-to-day activities; forensic radiography could well be used to bring these perpetrators to book.

2.6 BODY PACKERS

Body packing is the process of smuggling harmful drugs in the alimentary tract across the land, sea and air border.[76,79,107] The drugs pose serious challenges to public health and safety. Forensic imaging was used to reveal complete bowel obstruction in a 21 year-old man with the history of body packing.[108] Medical imaging plays a vital role in clinical examinations of body packing where clinical forensic teams like radiographers and radiologists detect the location and the number of packets of drugs for illegal purposes.

2.7 FORENSIC RADIOGRAPHY ON LIVING PATIENTS

As part of the undergraduate radiography programme, students learn about bone development and age determination where radiographs are valuable. The other area that is contributing to the field of forensic imaging is the used for radiographic examinations on patients for non-accidental injuries.[1,9] Body packing, gun-shot wounds and stab wounds are a relatively new field that plays an important role in legal medicine to resolve criminal cases.[109] Forensic imaging plays a crucial role in assessing living forensic patients, but is rarely applied by courts of law to get justice for victims due to ethical issues involving the radiation applied for forensic purposes.[110,111] Physicians use external examination as the gold standard in attending to living forensic patients.[112] However, this method examines external injuries only; internal injuries cannot be assessed by physicians during external examination. Forensic imaging reveals all the internal injuries in living forensic patients by using the appropriate imaging modalities.

In a study on forensic patients in South Africa conducted by Filmalter et al., among health care providers in emergency departments, the professionals noted that forensic examinations could be performed on living or dead individuals.[22] Examples given were the examination of victims of assault and sexual assault, gunshot wounds, stab wounds and abused children. Examples of deceased patients were those who were dead on arrival or those who died in emergency departments. It has been suggested that every trauma patient is a forensic patient unless proven otherwise.[22] Radiographers attend to many trauma patients and living forensic patients in their day-to-day activities without being aware that they are forensic patients. Studies have revealed that radiographers who attend to living forensic patients are not well

trained for such work, and are not aware of the medico-legal implications.[13,22,113] Also, some radiologists have limited knowledge on recognising the pattern and presentation of fractures and soft tissue lesions from living forensic patients when reporting on images from their work.[109,114]

2.8 METHODOLOGIES USED IN DIFFERENT STUDIES FOCUSED ON FORENSIC RADIOGRAPHY

Different methodologies were used in the sparse literature that the researcher found. Some studies used a qualitative approach while others used a quantitative approach. These studies had different aims and objectives.

In a qualitative study conducted by Walsh and Reeves, the role of the radiographer on a forensic team was explored.[115] Four radiographers were interviewed on their experiences, feelings and perceptions on their role in rendering forensic radiography services. Since forensic radiography is multifaceted, in this particular study the radiographers' experiences were explored in emergency and mass grave forensic radiography. Individual interviews were used to explore participants' perceptions regarding forensic radiography, and content analysis was used to analyse the data. The interaction of radiographers with other members of the forensic team, such as forensic pathologists, was also explored. The study demonstrated that the interaction of radiographers with other members of the team was cordial. One of the radiographers interviewed said that forensic pathologists see radiographers as professionals in the field, unlike the radiologists in normal clinical settings who regard radiographers as subordinate.[115] The researchers in the Walsh and Reeves study further explained that three out of the four radiographers have been involved in forensic radiography. The interviewees described the experience as daunting and challenging, but other members of the forensic team found it "interesting". The radiographers had developed their interests more in other fields of forensic radiography.[115]

A qualitative study on the role of Irish radiographers on non-accidental injuries was earlier conducted.[116] Ten radiographers were selected from the Republic of Ireland using a purposive sampling technique. Five radiographers were from a general hospital while the other five were from a paediatric hospital. Interviews were conducted with them and recorded; thematic analysis was used to analyse the data. The interviewees agreed that they had inadequate

training regarding non-accidental injuries in schools. Seventy per cent of the radiographers said that there should be adequate training in the area of non-accidental injuries so that the abused could be recognised and the medico-legal statutes involved were understood.[116] These findings can be related to the fact that radiographers attend to many non-accidental injuries without knowing that they could be forensic in nature.[10] It is therefore the researcher's argument that the inability of radiographers to produce images of high diagnostic value due to their lack of training and knowledge of forensic radiography can be detrimental to victims involved in these dastardly incidents.

Commented [MQ1]: The added

In a study to investigate the role of radiographers in child protection with regard to non-accidental injuries, focus group interviews were conducted among radiographers in the United Kingdom and the Republic of Ireland to explore perceptions regarding children presenting with non-accidental injuries.[117] The radiographers agreed that they have a role to play in child protection with regard to non-accidental injuries, but none said anything about the medico-legal law concerned with non-accidental injuries. The radiographers agreed that there should be more training in the area of non-accidental injuries so that abused patients were recognised and records were documented so that perpetrators of these heinous crimes are brought to book.[117] Interestingly, these studies reviewed agree with the opinion earlier expressed by the Society and college of radiographers (SCoR) that radiographers that attend to living forensic patients exposed to non-accidental injuries are not adequately trained to carry out the examinations and that they are not familiar with the medico-legal issues involved.[13,113,117] Studies reviewed for the purpose of writing this dissertation that followed a quantitative approach are shown in Table 2.8.1 on the next page.

Table 2.8.1: Summary of studies on forensic radiography that adopted a quantitative approach.

Author/s	Title	Research Design	Data collection instruments	Main Findings
Preethi et al., 2011	Awareness of forensic odontology among dental practitioners in Chennai, India	Cross-sectional study	Questionnaire	Inadequate knowledge, poor attitude, lack of practice
Selvajothi et al., 2014	Awareness of forensic odontology among legal practitioners, Chennai, India	Cross-sectional study	Questionnaire	Adequate knowledge among legal practitioners, Chennai, India
American Society of Radiologic Technologists, 2010	The state of forensic radiography in the United States	Cross-sectional study	Questionnaire	Radiology technologists need more training and education in forensic radiography
Elliott et al., 2017	Status of UK radiology trainee experience in post-mortem imaging	Cross-sectional study	Questionnaire	Radiology trainees have inadequate knowledge on forensic and post-mortem imaging
Ugodaga et al., 2015	Awareness of forensic odontology among Nigerian dentists	Cross-sectional study	Questionnaire	Knowledge and practice of forensic odontology among dentists is inadequate.

Having demonstrated in Table 2.8.1 above that the available studies on forensic radiography followed either the qualitative or the quantitative approach and that the main instruments used for data collection were interviews and questionnaire, it is important to note that either approach is acceptable. The justification for adopting the qualitative approach in the current study will be further elaborated upon in the following chapter.

2.9 CONCLUSION

Chapter two provided an overview of forensic radiography employed in forensic medicine. This was presented from an international perspective, followed by the African and eventually the Nigerian perspectives. The role of regulatory bodies was discussed with regard to the training of personnel and forensic radiography. The chapter further explained the challenges faced by radiographers in delivering forensic radiography services for both the living and the deceased. The chapter ended with reference to the studies that followed quantitative and qualitative approaches. The following chapter deals with the methodology, where the researcher explains in detail the methodology used to carry out the study.

CHAPTER THREE: RESEARCH METHODOLOGY

Research is to see what everybody else has seen, and to think what nobody else has thought.
Albert Szent-Gyorgyi.

3.1 INTRODUCTION

In reviewing the literature based on studies conducted on forensic medicine and forensic radiography in Chapter two, the researcher took into consideration the methodologies used by the authors as a guide to identify and justify the appropriate methodology for this study. Based on the problem that led to this study, the research questions and the aim of the study; a qualitative research approach and exploratory design were found to be appropriate. Information from other studies on forensic radiography was used to strengthen the decision of using a qualitative approach.

In this chapter, the researcher details the research methodology that was briefly presented in Chapter one. This includes: an overview of the qualitative research approach; the exploratory and descriptive research design; research setting; population and sampling of participants; the data collection instrument and process; and the data analysis process. The chapter also addresses the process followed to achieve trustworthiness.

Research methodology is a process used by a researcher to inform the reader of how the study was carried out systematically, and to analyse the data in order to answer the research questions.[29]

Based on the study's literature review, a qualitative approach was found to be appropriate for this study, as the researcher intended to gain a deeper understanding and in-depth information on the real-life experiences, attitudes and knowledge of radiographers and forensic pathologists with regard to forensic radiography services in Lagos state, Nigeria.[118,119]

3.2 QUALITATIVE RESEARCH APPROACH

A qualitative study can be used to reveal the truth from unknown areas. A qualitative method can be used to study issues in a natural setting in a holistic manner in order to obtain in-depth information from study participants.[29,119] A qualitative approach was adopted for this study as it is non-numerical and the data can be collected from small groups of people.[120] The intention of the researcher was to use a qualitative research approach to gain more in-depth information on the experiences, attitudes and knowledge of radiographers and forensic pathologist with regard to forensic radiography services in Lagos state, Nigeria.[121,122]

Forensic radiography is a new specialty in Lagos State and is faced with many challenges such as funding, lack of equipment and training for forensic professionals and its legal acceptance in the courts of law.[1] Exploring these challenges would improve the services of forensic radiography in Lagos state. Based on this view, the researcher chose to report from a qualitative approach. In a quantitative study, the researcher develops a hypothesis which can reveal results based on certain variables.[118,119] In this qualitative study, the researcher used one central question to explore the participants' views until data saturation occurred. The central question is: "What are the experiences, attitudes and knowledge of radiographers and forensic pathologists with regard to forensic radiography services?"

Before elaborating further on the processes followed in this study, Table 3.1 below presents the differences between qualitative and quantitative research. This is important as a way of justifying why qualitative research was found to be appropriate in addressing the problem that led to this study and for answering the main research question. The activities shown in this table are based on the literature review.[29]

Table 3.1: Differences between quantitative and qualitative studies.[118]

RESEARCH CONCEPT	QUALITATIVE RESEARCH	QUANTITATIVE RESEARCH
Subjective/Objective	It is subjective because the researcher is close to the participants	It is objective because the researcher is not close to the participants
Reasoning	Inductive	Deductive
Research design	Exploratory and Descriptive	Survey, Experimental and Descriptive
Role of the researcher	Bias: There is a connection between the researcher and the participants	Objective: There is no connection between the researcher and the participants
Data collection instruments	Observational, Documents, Individual and Focus group interviews	Questionnaire/Data collection sheet
Research questions	Open-ended questions: These questions allow participants to talk about their experiences and perspectives on a given subject.	Closed-ended questions participants' give only affirmative or negative answers (Yes or No).
Sampling strategies	Non-probability sampling Convenient sampling Snow ball sampling Purposive sampling Theoretical sampling	Probability sampling: Quota sampling Convenient sampling Random sampling Stratification sampling
Analysis of data	It can be used both in deduction and induction. Commonly induction. Induction starts with specifics and moves to generalisation and a conclusion is probable.	Inferential statistical analysis Deduction is a process that starts from generalization and moves to specifics
Presentation of results	Transcribed narratives: codes and categories.	Graphical presentation: graphs or tables

In Table 3.1, the differences between qualitative and quantitative research approaches are clearly demonstrated and purposefully guided the researcher on how to achieve the main aim of the study. The aim of the study as outlined in Chapter one is to explore and gain a deeper understanding about forensic radiography services so that the challenges faced by forensic professionals in Lagos state, Nigeria could be resolved. The three critical elements in qualitative research, as describe by Lichtman, are: understanding, description, and interpretation of human behaviour.[123] However, qualitative research can also be inductive and dynamic in nature. The critical elements described by Litchman are outlined in the following section.

3.2.1. Describing, understanding and interpreting human behaviour

The researcher decided to adopt qualitative research in this study because it could be used to describe and explore the experiences of the participants with regard to forensic radiography services.[44] Their views and perspectives regarding forensic radiography services were explored by the researcher to better understand the overall picture on ground at the time of the study. These views and perspectives cannot be quantified because they are non-numerical. However, based on the participants' views, the qualitative research approach was used to gather in-depth information to answer the research questions and achieve the study objectives. According to Denzin, qualitative researchers are concerned about the participants' perspectives and views about the world.[124] It was for that reason that the researcher decided to invite the participants to share their views and experiences on forensic radiography in Lagos state, Nigeria. The researcher was also looking at the opportunity to gather information on how to improve the quality of forensic radiography services rendered.

3.2.2 Approach to qualitative research

Due to the qualitative nature of the study, the researcher abandoned strict measures and adopted a fluid approach to the research methodology.[44] Based on fluidity in qualitative research, the researcher did not use philosophical theory because none exists on forensic radiography in Nigeria.[122] The researcher explored and discovered concepts that were new to the study area and based on this fact, an exploratory approach was found to be appropriate. Creswell,[118] states that to conduct acceptable interviews in qualitative research, one must be

logical and have a rational approach. A semi-structured interview guide questions can be used to get credible responses from the participants. (The questions formulated by the researcher can be found in Annexure C and D.)

3.2.3 Inductive and deductive nature of qualitative research

Based on findings from the literature, a qualitative researcher can use either inductive or deductive reasoning in deciding which analysis method to use, depending on the aim of the research.[125] In deductive reasoning, the researcher wants to know the established theory in the area of interest and then use their findings to confirm it.[44]

As no established theory exists on the perspectives of radiographers and forensic pathologists with regard to forensic radiography services, the researcher realised that radiographers are not well- skilled in post-mortem imaging and do not recognise living forensic patients. Due to this, the researcher considered using inductive reasoning to analyse the data collected from the different focus group interviews and identify the patterns with commonalities.

3.3 RESEARCH DESIGN

In section 1.9, the researcher provides an overview of the research design used in this study. The reason for selecting this research design is revealed in this section.

Research design is defined as an overall plan for conducting a study, as well as a method followed by the researcher to achieve the objectives of the study.[29] Based on this, the researcher adopted an exploratory and descriptive research design as indicated in section 3.3.1 below.The intention was to explore and describe the experiences, attitudes and knowledge of radiographers and forensic pathologists with regard to forensic radiography services in Lagos state, Nigeria. In this study the researcher found qualitative, explorative, and descriptive methods to be appropriate. Exploratory descriptive design is used by qualitative researcher when there is no specific category, such as grounded theory, ethnography or phenomenology.[44] It used to shed more light on a phenomenon when little is

known about the situation on ground.[126] Exploratory-descriptive design is elaborated upon in the following section.

3.3.1 Exploratory research design

Exploratory research design can be defined as the process whereby a researcher uses the phenomenon of interest to reveal the truth about the area of interest.[29,127]

It can be used to probe an area that has limited theory. Exploratory research design is in line with the inductive reasoning chosen for this study as indicated in section 3.2.3. The researcher used exploratory research to gain a deeper understanding of the challenges faced by the participants in delivering forensic radiography services in Lagos state, Nigeria. It was also used to ascertain the overall picture on ground in delivering forensic radiography services to living and dead forensic patients in Lagos state, Nigeria.[128]

3.3.2 Descriptive design

Descriptive design was adopted in this study to describe the participant responses to questions posed about a phenomenon with which they are familiar.[118]
Descriptive design can be related to exploratory design and is used to reveal or describe a situation on ground and to consider participants' responses to questions posed by a certain phenomenon that occurs in their known area.[44,118,] A descriptive design was found to be appropriate for this study because it could be used to describe the findings and analyse the themes which reflected the participants' voices.[36,129] Thus, the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services while working in the two government-owned teaching hospitals in Lagos state were revealed and documented. While the researcher did not find any literature on this given subject, the results of the study revealed the challenges faced by radiographers and forensic pathologists in delivering quality forensic radiography services in Nigeria.

3.4 RESEARCH PROCESS

A research process is the method used by a researcher to describe all the steps taken in a research area. It can also be defined as the rules or procedures used to study what researcher believes must be established about study area.[130] This includes accessing the study setting, the study population, the sampling method and collection and analysis of the data.[118] The research process is followed by qualitative researchers to ensure rigour in their studies.[29]

3.4.1 Negotiating access

Negotiating is a way of gaining access to a study setting by following the necessary ethical steps to study participants in a given area.[118] The researcher visited the participating institutions and scheduled appointments with the CEO and Heads of Departments (HODs) to discuss the study. The research proposal and ethics form were given to the CEO and HODs prior to the meetings. Approval was given to conduct the study. (Annexure A and B). Before the commencement of data gathering, the researcher considered th**e** National Health Act in South Africa on living participants which specifies that the positive and negative effects of a study must be explained to the participants. The researcher consequently visited the participants in their various departments, gave them an informed consent form and invited them to the focus group interviews. In this study, the researcher chose purposive sampling to select the participants.

3.4.2 Study setting

Due to the qualitative nature of this study, the researcher explored the participants' views and experiences in a natural setting.[118] The natural settings in this case were the two government-owned teaching hospitals in Lagos state, Nigeria, namely, Lagos State University Teaching Hospital (LASUTH) and Lagos University Teaching Hospital (LUTH) and the participants were recruited from Radiology and Forensic Medicine Departments. Focus groups made up of radiographers and forensic pathologists were identified for interview in these two teaching hospitals. Lagos State is the second most populous state in Nigeria, with 21million inhabitants and 20 local governments. In Nigeria, most forensic examinations of the dead and living are

carried out in these teaching hospitals. LASUTH is the only teaching hospital owned by Lagos State government with fifteen (15) radiographers and five (5) forensic pathologists while LUTH is a federal institution with fourteen radiographers (14) and no forensic pathologist. The researcher requested for permission from the Chief Executive Officers of the two hospitals before commencing of the study. Approval to conduct the study was granted by the University of Pretoria's Faculty of Health Sciences Research Ethics Committee (Annexure A and B). The researcher visited the hospitals and identified a quiet place such as seminar room or common room where he could meet the participants for the focus group interviews. A convenient common room in the two teaching hospitals was secured for the study participants.

3.4.3 Research participants

Research participants are a group of people who are recruited to take part in a study based on the specific criteria of the researcher's interest.[25] The researcher visited the radiographers and forensic pathologists during their monthly departmental meetings and asked them to participate in the study. During the focus group interviews each profession was grouped separately. The researcher conducted three focus group interviews: two with radiographers and one with forensic pathologists. Two focus group interviews were conducted in Lagos State University Teaching Hospital; one for radiographers and the other for forensic pathologists while only focus group interview was conducted for radiographers in Lagos University Teaching Hospital. In Nigeria, radiographers carry out radiographic examination on live patients and deceased for forensic purposes in their practice, while forensic pathologists investigate the cause and manner of death. Radiographers and forensic pathologists work together in the identification of deceased victims by using radiological methods.[1] The study populations for this research were radiographers and forensic pathologists working in two tertiary government-owned teaching hospitals in Lagos state, who willingly volunteered to participate and this is presented in Table 3.2., These numbers were based on the number of radiographers and forensic pathologists employed in these institutions.
All participants met the inclusion criteria outlined in section 3.4.2.5.

Table 3.2: Population of radiographers and pathologists at the two research sites

	Radiographers	Forensic pathologists

Hospital 1 LASUTH	15	5
Hospital 2 LUTH	14	0
Total study population	29	5

In relation to the total employees in the respective hospitals, the number of participants in this study was deemed acceptable because qualitative studies generally deal with smaller numbers.[118] In support of this, qualitative studies are said to focus on depth of information and not numbers, as it is the case in quantitative studies.[118]

3.4.3.1 Radiographers

There are three competency standards defined as: high diagnostic images; knowledge of ionizing radiation; and sound clinical judgement, which are used by radiographers to assist medical practitioners in their management of clinical conditions.[131,132] Radiographers are educated in anatomy, patient positioning, radiation safety, and patient care.[9] Radiographers produce images of high diagnostic value and adhere to the "As Low As Reasonably Achievable" (ALARA) principle to protect their personnel and the general public from radiation. They specialise in magnetic resonance imaging, computed tomography, nuclear medicine, mammography, industrial radiography and, more recently, act as forensic examiners (based on their educational background) for both the living and the dead. Radiographers in Nigeria are registered with the Radiographers Registration Board of Nigeria which controls the practice of radiography in that country.[133]

3.4.3.2 Forensic pathologists

In Nigeria, radiographers attend to the living and dead forensic patients in their practice, while forensic pathologists investigate the cause and manner of death. Radiographers and forensic pathologists work together in the identification of deceased victims by using radiological methods.[1]

To practice in Nigeria, forensic pathologists will have earned a bachelor's degree in medicine followed by four to five years of training in anatomic pathology. Anatomic pathologists travel to Europe, Germany and the United States for training in forensic pathology because there are no training institutions presently in Nigeria. Based on the focus group interviews in this study, the researcher established that forensic pathologists in Nigeria deal with dead forensic patients. According to the Society of Radiographers, the role of forensic pathologists in seeking forensic radiography examinations of the dead is to reveal the cause and manner of death in order to complement their autopsy findings.[10] However, requests for living forensic patients must be treated as non-medical, and justification must be provided on the importance of the requested examination.[10]

3.4.3.3 Sampling strategy

A sampling strategy is adopted by a researcher when selecting a representative population.[31] It can also be used by a researcher to select a subset of the population which has the same characteristics as the target population for the study.[118] Purposive sampling is defined as a non-probability sampling technique that is judgmental.[118] It is used in both quantitative and qualitative studies, but is most frequently used in qualitative studies. The researcher intentionally selects participants based on the characteristics of a population and the objective of the study. Purposive sampling was found appropriate for this study. It is used by qualitative researchers to select participants who can give rich narratives during focus group interviews in a study.[118] The participants in this study were radiographers and forensic pathologists working in teaching hospitals in Lagos state, Nigeria, who met the inclusion criteria. The researcher organised homogenous focus group interviews for the invited participants. Homogeneity is defined as a group of participants with the same characteristics, such as educational qualification.[118] In this study, participants of the same professional qualification were put together in the same group which allowed them to talk freely with their colleagues. Each focus group interview consisted of five to seven participants per group. Each interview took about 50 to 60 minutes to allow the participants to share their experiences, attitudes and knowledge about forensic radiography services in Lagos state, Nigeria.

In the first teaching hospital, data was collected in September 2018, and in the second teaching hospital, in December 2018. The participants signed consent forms and agreed to

the use of audio recordings of the interviews.[118] The researcher went through basic facilitation and interview training under his co-supervisor in order to efficiently carry out the focus group interviews.[29] Field notes taken by the research assistant were used to obtain trustworthy data for the study.[29] The researcher introduced the topic to the participants assured them that their identities would remain anonymous, that all information gathered was confidential and that their participation was voluntary and could be withdrawn at any time.

3.4.3.4 Inclusion criteria

Inclusion criteria can be defined as the characteristics that participants must have in order to be included in a study, and who qualify based on certain criteria set by the researcher.[29] The researcher in this study selected participants who could give in-depth information that would validate the results of the study. The study participants were radiographers who had attained degree qualification in radiography or its equivalent who were registered with the Radiographers Registration Board of Nigeria and were working in government-owned teaching hospitals in Lagos state.

Participants are were also forensic pathologists who had degrees in medicine and had undergone fellowship training in anatomic pathology with follow-up training in forensic pathology, or they were anatomic pathologists working under the supervision of forensic pathologists in government-owned teaching hospitals in Lagos state.

3.4.3.5 Exclusion criteria

Exclusion criteria are defined as characteristics of people who should be excluded from a study.[29] It is used by researchers to exclude possible participants who do not meet the requirements set for a study.

The following categories of practitioners were excluded from this study: intern radiographers doing their one-year compulsory internship training after the radiography degree, and resident doctors working in forensic pathology departments.

3.5 DATA COLLECTION PROCESS

Data collection comprises all the steps taken by the researcher in the collection of data to answer the research questions and achieve the aims and objectives of a study. In the case of this study, the researcher's co-supervisor advised on how to plan the focus group interviews, audio recordings, field notes, etc.[36]

The aim of conducting this study was to explore the views and experiences of radiographers and forensic pathologists regarding forensic radiography services in Lagos state, Nigeria. The researcher aimed to understand and describe the participants' perspectives regarding the delivery of quality forensic radiography services to living and dead forensic victims.

In a study conducted by American Society of Radiologic Technologists (ASRT) on a forensic radiography survey among personnel who performed forensic radiography examinations, questionnaires were used to assess the training and the equipment available to personnel in the field of forensic radiography. These assessment tools yielded statistically meaningful information. However, the study did not explore the participants' views on forensic radiography.[9] In another study by Elliott et al., questionnaires were used to evaluate the knowledge of radiology residents on forensic and post-mortem imaging.[42] The results of the study revealed that the radiology residents had inadequate knowledge on the aspect of forensic and post-mortem imaging. Based on the outcomes of these studies, which reported from a quantitative point of view, the researcher gained in-depth information and was encouraged to use focus group interviews to explore this study's participant views regarding forensic radiography services delivery.

3.5.1 Focus group interviews

Focus group interviews help in gaining in-depth information from the participants, specifically in this study for the efficient service delivery in the area of forensic radiography. Focus groups can be used to gather in-depth information from participants who share their experiences on a given topic in a group discussion.[134] These discussions allow the researcher to raise probing questions, to explore the research problems, and ultimately achieve the research objectives through new findings that emerge. Focus group interviews are a

conversation between the researcher and the participants with the aim of revealing the overall experience in the study area.[128]

The researcher encouraged the participants to share their experiences on forensic radiography by probing, listening and paraphrasing.[29] The researcher shared the view of other researchers who stated that focus group interviews should consist of six to eight participants.[118,127] Having more than eight participants in a focus group interview makes a group rowdy and analysis of the data becomes complex and time- consuming.[119] In this study the participants were grouped in their different homogenous groups so that the researcher could generate in-depth information from the data collected.[135]The pathologists' group included one forensic pathologist and four anatomic pathologists. In the radiographers' group included senior, principal, chief and deputy director radiographers. Semi-structured questions were used by the researcher to guide the focus group interviews. This was done to allow each participant to answer the same questions. In the following section, the researcher explains how the focus group interviews were organised.

3.5.2 Logistics of the focus group interviews

In preparing for the focus group interviews, the researcher put some logistics in place to ensure that the interview yielded meaningful information on the given topic.[136] The steps taken to achieve successful focus group interviews are shown below; they include the preparatory phase, the interview phase, and post interview phase.

3.5.2.1 Preparatory phase

In this phase the researcher outlines all steps taken in the organisation of the venue, the recruitment of participants, arrangement of the focus group, and recruitment of the research assistant.

(a) Arrangement of the focus group interviews

The forensic pathologists' interview was conducted first because the researcher wanted to have an overview on forensic radiography. Forensic radiography is a relatively new field in Nigeria that has been used by forensic pathologists during mass disasters to complement their autopsy findings.[1] The researcher wanted the forensic pathologists to share their experiences regarding personnel such as radiographers, the equipment they

need, challenges faced and services delivered during mass disasters. The in-depth information gained from the forensic pathologists was used to raise more probing questions with the radiographers during their focus group interviews. As an insider in radiography, it was easy to understand the challenges radiographers face when delivering forensic radiography services for the living or the dead.

(b) Setting the interview questions

The researcher plays a significant role in setting interview questions that can assist in answering the research questions and help to achieve the aims and objectives of a study.[29] Questions for the focus group interviews were formulated based on the information presented in the introduction and the literature review of the study. A semi-structured interview guide with open-ended questions was developed by the researcher for the focus group interviews. These sets of questions allowed the researcher to explore the participants' experiences and gain rich information from the interviews.[129] The researcher structured seven questions for the radiographers (Annexure D), and five questions for the forensic pathologists. All questions were set in the same format, and were devised in consultation with the study supervisors.

(c) Organising the venue

In organising the venue, the researcher followed the suggestion of Krueger and Casey[136] which states that the participants and researcher must be comfortable, the participants should be able to get to an easily accessible venue on time and be aware that the discussion will be recorded, the venue or setting must be comfortable and conducive for data collection. The researcher had visited the two hospitals to locate a quiet, comfortable place where the focus group interviews could be conducted. In the first hospital a seminar room was allocated and the researcher and research assistant arrived before the participants. The researcher arranged chairs around a table and participants along with researcher sat face-to-face for easy communication. This yielded meaningful information from the in-depth data collected.[29] The researcher placed identification numbers in front of each participant in the focus group interviews. For the second hospital, a common room was allocated for the interviews. The interview date and time were unanimously decided on by the participants and the various head of departments (HODs).

(d) Recruitment of participants

In the process of recruiting participants for a study, the researcher should provide transport fares for those participants coming from a distance to the venue.[136] The

researcher visited the participating hospitals to recruit participants and identified those who were eligible and able to give in-depth information on the study subject. The participants were recruited face-to-face in interaction with the researcher who explained the study area and answered their questions.[29] The researcher further informed them that approval had been granted by the ethical committee to conduct the study in the participating institutions (see Annexure A and B). In the first hospital, the HODs of the forensic pathologists and radiographers chose a convenient time and date to avoid disruptions during the interviews. The time and date were communicated to the participants by the researcher. In the second hospital, the head of the radiographers chose the date and time. The interviews were conducted on the day of their monthly departmental meeting. The researcher reminded the HODs telephonically two days before the interviews, and requested them to remind the participants. In all, the researcher recruited 19 participants for the three focus groups.

(e) Recruitment of research assistant

The research assistant was an undergraduate student studying nursing, who could read and write with ease and was adept at taking field notes, having previously worked with researchers in that field. The research assistant also served the refreshments and managed the audio-recordings. At the end of each focus group the researcher and research assistant cross-checked the field notes against the audio-recordings to ensure that they had been correctly taken. The research assistant did not sign a consent form but agreed to honour the confidentiality of study information.

3.5.2.2 Conducting the focus group Interviews

Before commencing the interviews, the researcher introduced the topic to the participants and explained why focus group interviews were appropriate for the study. A good rapport with the participants was established and the intention to gain meaningful information from the participants during the interviews was emphasised.[127] This enabled the researcher to gain rich narratives from all 19 participants across the interviews. The first focus group interview of forensic pathologists comprised five people, and the second and third focus group interviews of radiographers each comprised of seven people. The focus group interviews were conducted in quiet environments and in English language. The researcher's interview guide was used for probing questions. Each focus group took between 50 to 60 minutes. Field notes

and audio-recordings were managed by the research assistant. The researcher ended the interviews when the data became saturated.

(a) The Role of the Researcher

In this study the researcher played a multifaceted role. The researcher set the interview questions and also served as interviewer in conducting the focus group interviews.[29] The researcher explained the purpose of the study and encouraged the participants to share their relevant experiences with regard to forensic radiography. Based on the cordial relationship established with participants,[136] the interview guide was used to avoid participants narrating irrelevant experiences that could prevent rich narration from being obtained before data saturation was reached.[135] Based on the cordial relationship established with the participants before and during focus group interviews, the researcher was able to get rich narration and data saturation from the participants.[136] Three focus groups interview were conducted by the researcher. Two focus groups interviews for the radiographers and one focus group interview for the forensic pathologists as reiterated earlier. The researcher closed the door during focus group interviews but there was notice on the door that focus group interview was in progress.

(b) Pros and Cons of Having the Researcher as an Insider

In a qualitative setting the researcher is an insider. The advantage of having the researcher as insider is that the discipline of the study is fully understood. This allows for full understanding of the terms or jargon used by the participants during the interviews, and enables the researcher to raise probing questions to gain a rich narrative from the participants.[135] The disadvantage of having the researcher as an insider is that bias could occur during data collection. Accordingly, the interview questions were scrutinised by researcher's supervisor and co-supervisor to ensure that no particular focus group was favoured and that no bias could occur during the interviews.

(c) Radiographers' Focus Group Interview

The researcher conducted the radiographers' focus group interview in the radiology department seminar room with seven participants in attendance. As an insider in the radiography profession, the researcher welcomed the participants using terms familiar to the profession and gave an overview of the study area. The researcher asked the participants to sign the consent form and give their permission for the audio-recording. The radiographers felt relaxed with the researcher. Based on the aim of this study in Section 1.3, the researcher explored the experiences, perspectives and challenges faced

by participants with regard to the delivery of forensic radiography services. The question guide for radiographers is included in Annexure D.

(d) Forensic Pathologists' Focus Group Interview

The focus group interview with five forensic pathologists took place after their daily autopsy in the departmental seminar room. Before commencing, the researcher welcomed the participants, encouraged them to sign the consent forms and introduced the topic. The interview question guide for forensic pathologists can be seen in Annexure E. The researcher created good rapport with the participants to gain rich narration on their views concerning the study area.[29]

3.5.2.3 Post Interview Phase

At the end of each interview the researcher thanked the participants for participating despite their tight schedules in the hospitals. The participants were informed by the researcher that the findings of the study would be made available to them on request, and that their confidentially would be maintained.[29]

The researcher then proceeded to the next stage in the research process – the organisation of the data.

3.6 ORGANISATION OF THE DATA

The method used for organisation of data in this study was to group the collected data from the interviews into structured segments, which helped facilitate the analysis.[137] The audio recordings were computer-saved as a backup after each of the interviews. This recorded data was transcribed verbatim by the researcher. The researcher and the qualitative analyst used both computer-based software (AtlasT1) and manual organisation of the transcribed data to identify and form the codes. (See Annexure F)

3.7 DATA ANALYSIS

Data analysis is the process used to systematically analyse the organised and synthesised collected data.[29] It can also be defined as a process of sequential steps to be followed from the specific to the general, involving multiple levels of analysis.[119] There are different approaches to the analysis of focus group interviews.[46,138] According to Barbour, the analysis

of focus group interviews should be based on each participant's comments, in order to gain deeper understanding of the study area within the group.[139] However, researchers have earlier been advised to ensure that the mode of interaction within the focus group and the perceptions that come from the discussion are observed.[135] There is yet another view point which is that both individual and group data should be analysed together, using thematic analysis.[138] Due to its fluid and non-restrictive nature, qualitative research gives the researcher space to explore the areas of interest in line with the aims and objectives of the study. Based on this variety of opinions, the combined approach whereby analyses of data through the individual and collective experiences of each category of participants to reflect the views of previous researches[135,138,139], was adopted in this study. Thus, thematic analysis was used to analyse the focus groups' interview data. The thematic analysis process is discussed below.

3.7.1 Thematic Analysis

Thematic analysis was used in this study for data analysis because it can discover patterns and themes.[140] The researcher analysed data generated from this study under the guidance of the co-supervisor and was also assisted by a qualitative research expert. The researcher listened repeatedly to the audio recordings of the focus group interviews. All interviews were transcribed by the researcher. To ensure anonymity, the participant's names were not mentioned during audio recordings. This allowed the researcher to understand the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services. The researcher identified points with commonalities and differences and grouped these under different codes and categories, finally emerging as themes. The research findings were derived from the focus group interviews and the researcher's interpretation of these themes. Thematic analysis of the data was done by following the five steps stated by Creswell: reading and familiarising oneself with the data, coding the data, identifying categories, generating descriptions of themes, and representing the description of themes.[118,141]

3.7.1.1 Advantages of Thematic Analysis

Through thematic analysis, the researcher was able to present the participants lived experiences about forensic radiography and associated services as provided in Lagos state,

Nigeria. Thematic analysis is said to be flexible. It can be used in different circumstance and is useful in summarising and organising cumbersome data.[142,143]

3.7.1.2 Disadvantages of Thematic Analysis

The analysis in this method can be poorly conducted.[144]
Despite the disadvantages stated above the researcher chose to use this method. However, the method is good for the inexperienced qualitative researcher.

3.7.2 Data Analysis Process

Thematic analysis followed the frame work of Clarke and Brown.[141]
The phases followed in analysing the data are outlined below.

3.7.2.1 Step 1
Familiarisation with the data
The researcher took the first step by listening repeatedly to the audio recordings from the three focus group interviews and convert it into written text before starting the data analysis.[34] The researcher familiarised himself with the data by transcribing the focus group interviews verbatim,[29,45] This made data analysis simpler. During transcription the researcher took note of all the participants' impressions, the questions asked, and the probing questions raised during the focus group interviews to gain rich narrative. The initial and main points that emerged were identified by reading transcripts of the field notes using an interpretive method.[45]
3.7.2.2 Step 2
Generating initial coding
Coding is the reduction of data without losing its meaning.[34,146] The researcher coded the data by labelling phrases and sentences from the transcribed data without losing their original meaning, after reading the codes several times. The labelled data was organised into categories and sub-category groups. Similar codes identified from the transcribed data were grouped together.[146]

3.7.2.3 Step 3
Searching for themes

The different codes were grouped by the researcher into potential themes by using tables to present the themes that emerged from participants' experiences regarding the forensic radiography services. The participants' comments were highlighted during coding to develop themes. A theme captures important information about the data in relation to the research questions and represents a level of patterned response or meaning within the dataset.[140]

3.7.2.4 Step 4

Reviewing themes

All themes that emerged were evaluated by the researcher. This involved "reading between the lines" and identifying themes that represented the participants' experiences regarding the forensic radiography services. The researcher developed descriptive themes from the collected data to represent the participants' views on the study area.[146]

3.7.2.5 Step 5

Defining and naming themes

In this step, the researcher identified emerging themes from discussion of the categories, and a final set of themes interpretive of the data then emerged from the categories. The themes followed inductive reasoning as described in section 3.2.3. and answered the study's research questions. The emergent themes and findings of the study are presented in Chapter four. The researcher involved his supervisor and co-supervisor in the interpretation of the emergent themes to strengthen the credibility of the themes.

3.7.2.6 Step 6

Producing the report

In this final stage, the results of the study were produced by extracting information from the data analysis on how the themes emerged. Due to qualitative nature of the study which is subjective the researcher used different methods to ensure trustworthiness in the results of the study, as described below.

3.8 MEASURES TO ENSURE TRUSTWORTHINESS

Trustworthiness is a process used by researchers to ensure that their study is scientifically conducted and that the findings are credible and reliable as outlined by Lincoln and

Guba.[29,147] There are four criteria to ensure the trustworthiness of findings namely: transferability, credibility, dependability and confirmability. These parameters play a vital role in ensuring that the outcomes of a study research process is authentic. Focus group interview questions must be confirmable, credible, dependable, and transferable to yield consistent results from the participants.[29,148]

3.8.1 Credibility

The credibility of research findings is defined as confirmation of the truth.[147] Credibility is used by the researcher to establish if the research findings represent the data drawn from the participants.[149] The following activities were carried out to achieve credibility in this study:

(a) Audio recordings of the participants' information and field notes were taken by the researcher and research assistant.
(b) Identification was made of the most appropriate participants for the research: radiographers and forensic pathologists working in teaching hospitals in Lagos state, Nigeria who attend to non-accidental injury, trauma patients and victims of mass disaster in their practice. However, every radiographic examination could be forensic in nature.
(c) Prolonged engagement: In qualitative research, this can be referred to the time the researcher spent with participants in conducting focus group interviews until data saturation is reached. This builds credibility of the data.[147,148]
(d) Member checking: once the focus group interviews were transcribed, the study participants confirmed the transcriptions. In this way the participants validated their contribution to the study findings and consensus was reached.[118,148]
(e) Peer debriefing: The researcher generated knowledge by exploring the experiences, attitudes and knowledge of the participants with regard to forensic radiography services in Lagos state, Nigeria. Thereafter, the researcher's supervisor, co-supervisor and impartial colleagues in the field of radiography worked with the researcher in order to contribute to the study's validity. Credibility is equivalent to validity and reliability in quantitative research and this can be assessed by the extent of participant's concordance.[25]

3.8.2 Confirmability

Confirmability refers to the process used by a researcher to ensure that the data collection and data analysis accurately reflect the participant's voices without bias or any threat from the researcher to the participants'.[118] Confirmability in qualitative research can be used to establish interpretation of the data and confirmation of the findings. In qualitative research, confirmability can be used to confirm that the findings are not in the imagination of the researcher.[29] This gives the reader good understanding that the research can be reproduced in the same setting or another setting. The researcher checks the verbatim transcripts in the coding of the data and shows the verbatim transcripts to the supervisor and the co-supervisor to confirm that the researcher did not influence the data collected. The views of the participants on forensic radiography services were recorded and the informed consent forms are available from the researcher's supervisor.

3.8.3 Transferability

Transferability is the process by which the results of qualitative research can be generalised and applied in other settings.[118,148] This can be achieved by describing the methodology adopted by the researcher so that other researchers can replicate the study. In this study, field notes were compared with the transcribed data transcripts, the researcher describes the research settings and details the study findings thus providing sufficient data for the study to be replicated in another settling.[149,150]

3.8.4 Dependability

Dependability is the process used in assessing the consistency of the research findings.[31] This implies that if a study with the same participants is repeated in a different location, the same or similar results should be obtained. Trustworthiness can describe a study where the conclusion of the research findings is dependable. In this study, the researcher has kept the reader informed of all the activities that took place and the challenges faced in achieving the objectives of the study through the research questions, research methodology, data collection and data analysis.[119,151] Two supervisors checked all steps taken in the study.

3.9 CONCLUSION

The researcher chose to use qualitative research methods in this study. The differences between quantitative and qualitative approaches were tabulated in detail, as were the differences between inductive and deductive reasoning. The exploratory and descriptive research design used to explore and describe the situation on the ground at the time of the study, was elaborated upon, followed by a description of the study's research process. The method of selecting participants and negotiating access to the interview settings was discussed. The sampling strategy and data collection process, including the focus group interviews were detailed. The aim and objectives of the study were used to identify the obstacles faced by radiographers in delivering forensic radiography services in Lagos state, Nigeria. The outcomes of the data analysis process and the study results are presented in Chapter four.

CHAPTER FOUR: RESULTS AND DISCUSSION

Coming together is a beginning, keeping together is progress, and working together is success

Henry Ford

4.1 INTRODUCTION

In the previous chapter, the research methodology was discussed in detail, and the processes followed from data collection to data analysis were shown. The results of the data analysis of the focus group interviews are presented in this chapter. The aim of the study was to explore the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services. The research question was: What are your experiences, attitudes and knowledge with regard to forensic radiography services in Lagos State? This chapter presents the results that emanated from the thematic data analysis.

4.2 DATA ANALYSIS OF FOCUS GROUP INTERVIEWS

Following transcription of the data, the researcher engaged a qualitative research expert, who assisted in the data analysis. To gain understanding on how the research expert arrived at the themes and categories, the reader is referred to Annexure G. This annexure is a presentation of the data analysis, where the expert attempted to show from where the themes emerged. To assist the reader in understanding the emerging themes, it is important to first understand the codes and categories. In the next section, the researcher presents a brief discussion on the codes and categories, to demonstrate how they were arrived at. The discussion is supported by a narrative from the research participants on their experiences, attitudes and knowledge regarding forensic radiography services. These narratives further demonstrate the identified codes which contributed towards the categories presented.

Code can be defined as the process of reducing data without losing the original meaning while Category can be defined as the process of grouping similar codes together.[146]

4.3 IDENTIFIED CODES AND CATEGORIES IN RELATION TO THE QUESTIONS ASKED

In this section, the researcher presents the results in accordance with the answers provided by both the radiographers and the forensic pathologists. The decision to make the whole group of participants the unit of analysis was based on the fact that many of their responses were similar and hence there was no need for data triangulation. The reader is reminded that during the focus group interviews similar questions were asked of both the radiographers and the forensic pathologists. It was therefore important that the radiographers and forensic pathologists were taken together as the unit of analysis. For presentation of the results, codes were allocated to the participants as follows: R3A Radiographer in focus group interview A, and so on. FP1 refers to the forensic pathologists who was allocated numbers from one, and so on. A unit of analysis is defined as the major entity the researcher studies.[146] The first question on experiences is for both groups. In Annexure G Identified codes and categories that relate to the first question asked is presented first.

4.3.1 Responses to "What experience do you have in forensic radiography?"

As indicated, the responses to the first question are presented in Table 4.1 below. This is followed by narratives from the radiographers and then those from the forensic experts.

Table 4.1: Identified codes and categories related to the first question

Identified codes	Categories/subthemes
No experience Limited experience Strenuous experience	Experience in forensic radiography

4.3.1.1 Experience of radiographers in forensic radiography

Participants' experiences regarding forensic radiography in both living and dead patients varied. As detailed in section 3.4.2.1, radiographers performed forensic radiography examinations on the living and the dead when resolving criminal cases, identification of deceased, or to complement the autopsy findings as requested by the pathologists or

physicians. To address the category on participant experiences, reference is made to the teaching and learning programmes as well as their experiences in performing forensic radiography services.

From the radiographers' point of view with regard to their experiences in performing forensic examinations.

R3A has indicated that, *I have limited experience in forensic radiography due to lack of training programmes from school. In my former centre I conducted forensic radiography examinations on a dead patient. The body was still fresh; they were trying to ascertain the cause of death. However, my major experience was here in this hospital. I did forensic radiography examinations on an individual that was set ablaze during violence; they were also trying to confirm the identity and some of the body parts even fell apart.*

The radiographer further said: *there was not enough protection against infection to me it wasn't interesting just tedious, positioning was also difficult even after immobilisation. This also led to poor radiographs*

R 2B: *I have also had an experience that involved a dead person. They were night crawlers and were found dead and no one knew the cause of death and we had to do some sort of skeletal survey. I have also had to deal with a battered child and a skeletal survey was done too. I was afraid at first but after getting it. I was okay.*

R3B explained: *here in LUTH I saw the dead body of a female that was strangulated as a result of domestic violence. A full body computed tomography (CT) scan was done but we did not get the final details of the investigation.*

Another issue that was raised in relation to radiographers' experiences with forensic radiography, related to the examination of the living.

R1B explained*, I had the experience of performing forensic radiography on one army officer who was shot by armed robbers but later died. I have also imaged a living patient who was stabbed and the knife was left in the body of the patient. The radiographer further said: I didn't know that X-ray examination carried out living patients can be forensic but now I know. This can be a result of lack of training in forensic radiography*.

With regard to forensic radiographic examinations during mass disasters that occurred in Lagos State, the radiographers who participated in performing forensic radiography examinations during the mass disasters expressed their challenges, some of which were:
R4A: *In 2013 during my internship, there was a plane crash and the bodies were brought in." The radiographer expressed concern about the physical and emotional challenges faced*. The radiographer further said that positioning was not easy and image processing was stressful too. The forensic pathologists were friendly to me but not all the radiographs were adequate. *Although, I had no experience, this was my first time of doing forensic radiography. I can attribute this to lack of training in forensic radiography from school.*

This was echoed by R2A: *My experience in forensic radiography was during DANA crash. Even after two weeks they were still bringing in bodies and most times these bodies were in pieces and decomposing. It was a really disturbing period. The work was really tedious we had to leave late about 9-10pm and the positioning was difficult since the body could not take instructions. The pathologists kept on pressuring us to be fast without considering the constraints and sometimes these bodies were brought in during the day affecting the live patients. We had to make arrangements for the bodies to be brought in during call hours.*

R5A said*: I have gathered some experiences when doing forensic radiography for the dead, especially during the plane crashes that happened here in Lagos state. The best I can say is that for me, the radiography was challenging and time consuming.*

Having presented radiographers experiences with performing forensic examinations, the views and experiences of the forensic pathologists are presented below to show the similarities and differences.

4.3.1.2 From the forensic pathologists' perspectives

Regarding forensic pathologists and their experiences with forensic radiography, it seems that the forensic pathologists experiences in forensic radiography were only about the dead, although based on their narratives, they were aware that forensic radiography examinations can be performed on living patients as well.

FP1 said: *During the Dana plane crash there was a delay from radiographers in getting results.* The pathologists further said*: there was a long time interval between taking the X-rays and getting the results. Radiographers and some of the radiologists need to show more interest in forensics especially on the autopsy. I have seen a few of them showing interest but some of them vehemently and grudgingly oppose it. The forensic pathologist further explained: I would say radiographers in this hospital don't like doing X-rays for the dead due to ignorance on their part although they are primarily used to living patients in their clinical practice.*

FP3 said: *Based on experience radiography produced by radiographers during forensic radiography examinations are okay to use but they have to make a lot of repeats.*

FP 2 further said: *radiographers are unwilling to perform forensic radiography examination on the dead. You deduce this from their actions when they are called for such.*

FP 5 added: *initially they are unwilling to participate. However, it is a matter of leadership. If you can get the head of radiology or radiographers to be informed, they come willingly to perform the examinations but they are not well skilled in the area of post-mortem imaging.*

On specialised techniques deployed for forensic investigations, FP3 said: *we talk more of the post-mortem purposes. We can also use it for cases of child abuse. We should not forget to mention the aspect of gunshot cases. Forensic radiography was used in disaster victim identification and it was a good success. The radiographs produced and reported on were of good quality.*

FP4 said*: I think of disaster victim identification and also investigate gunshots. Application of radiography to forensics is used in cases of child abuse, sports, customs, immigration, even in physical abuse, domestic violence.*

Having assessed the forensic pathologists' experiences about forensic radiography services. Forensic pathologists complained about their challenges in getting timely results from radiographers. This can be resolved with cordial relationships.

Before embarking on the following questions, the following section focuses on the literature review that relates to the experiences of radiographers and forensic pathologists regarding forensic radiography examinations.

4.3.1.3 Literature on experiences of radiographers and forensic pathologists regarding forensic radiography service

In section 1.7 of this study, it was said that the experiences of radiographers and forensic pathologists were defined as the participants' participation in forensic radiography examinations both on dead and living forensic patients and the quality of the images produced.[27] According to SCoR in the UK and to IAFR, every radiographic examination could be forensic in nature, both for the living and the dead and can be subject to scrutiny in a court of law.[4,10] For every radiography examination performed, justification and optimisation must be met by the radiographers. In the field of radiography, justification means that the benefit of any examinations to be conducted must outweigh the risk in line with ALARA principle.[153] Radiographers undertaking forensic examination of living and dead must follow all relevant regulations of diagnostic imaging, such as optimisation and authorised referrers.[10] Radiographers may reject any forensic examinations if there is no authorised referrer and the justification to perform the forensic radiography examinations is questionable.[5,10] In clinical practice, radiographic images produced by radiographers are used to establish accidental and non-accidental cases in living patients.[86] However, it is important that radiographers should be aware that images produced for living patients can be used legally as well as clinically. In a study conducted by Kadlas et al. on forensic radiography surveys, it was reported that radiographers who performed forensic radiography examinations on the living are not aware of the social, legal and ethical policies involved.[9] This is similar to a study conducted by Rigney et al. in which it was reported that radiographers who performed forensic radiography examinations on the living are not aware of the medico-legal issues involved.[116]

This can relate to the radiographers' view point–that. *I had the experience of performing forensic radiography on one army officer who was shot by armed robbers but later died. I have also imaged a living patient who was stabbed and the knife left in the body of the patient. The radiographer further said: It is quite interesting I didn't know that X-ray living examinations carried out patients can be forensic but now I know. This can result from a lack of training in forensic radiography* as explained by R1B

A study on the current status of radiology trainee experiences in forensic radiography in the area of post-mortem imaging in the UK.[42] A Survey Monkey questionnaire was sent to 261 radiology trainees in London. The survey comprised of four parts demographics of the respondents, personal experience, certification and reporting. This study revealed that radiology trainees had limited experience in post-mortem imaging and further indicated that 85% of the respondents did not have a good understanding of post-mortem imaging in their current practice.[42] Seventy-one per cent were interested in gaining experience during training and 59% agreed that post-mortem imaging should be included in their training curriculum. This can be related to some radiographers' narration R3A said that I have limited experience in post-mortem imaging and have to make a lot of repeats before I can produce good images R3A. I have no training experience in forensic radiography. *This relates to the FP5 comment that radiographers are not well skilled in the area of postmortem imaging.*

Mass disasters can be defined as any occurrence where the numbers of fatalities are greater than local arrangement capacity.[10] This was another issue raised in terms of the challenges faced by participants when delivering their services. In a study on emergency graveyards and mass disaster it was revealed that radiographers who participated in mass disasters complained about the emotional and psychological effects faced when delivering forensic radiography services.[115] This is in line with comments from radiographer R2A, *who expressed concerns about facing the physical and emotional challenges. The radiographer further said that the positioning of dead bodies was not easy, and that image processing was stressful.*

Having assessed the issues raised on experiences of radiographers and forensic pathologists regarding forensic radiography services, the following section deals with their perceptions regarding forensic radiography services.

4.3.2 Responses to "What comes to mind when asked about forensic radiography?"

As demonstrated in Annexure G, different codes were identified under this question. Some of the codes were repeated by the different participants and hence they were grouped to form one category. For this question, codes and their associated category are presented in Table 4.3.

Table 4.2: Codes and categories related to the second question

Identified codes	Categories
Dead people Investigations Child abuse Gunshots	Perceptions of forensic radiography

4.3.2.1 Participants perceptions of forensic radiography

When asked what came to mind, the participants have different Perceptions on forensic radiography. The radiographers' perceptions are presented below, followed by forensic pathologists' perceptions.

(a) Radiographers' perceptions about forensic radiography.

R1A said that: *it is normal to X-rays bodies of the dead but at times the bodies smell and are lacerated and can be difficult to position- hence additional views may be needed.*

The radiographer raised concerns about the impact that imaging dead bodies might have on the patients and members of the public waiting in radiology department at the moment when a forensic pathologist brought in dead bodies for imaging. The radiographer further said that the morgue should be equipped with imaging modalities.

R7A said*: I don't like forensic radiography examinations of the dead because of the positioning and infections that could be contacted. However, if these can be taken care of I might be interested.*

R4B said: *A gunshot victim was brought in dead and we had to do a total body survey to find the bullet in the body by using conventional X-rays. We could not find it. If we had tried other imaging modalities we might have had better luck.* R8A said*: For me it all about the dead in supporting autopsy findings.*

R 5B *I once attended and did CT for a living patient and saw cocaine in the images but I don't know if that is forensics. Making reference to the victims of trauma and, child abuse that radiographers attend to on a daily basis* R5B*: there should a separate department to report to when radiographers suspected such in a patient. There is a need for a law that will guide the processes to be followed*

Radiographers gave their advice and suggestions on how to recognise child abuse and curb this menace.

R5A said: *there should be a law concerning attending to patients that come in with suspected abuse trauma.*

In addition to what my colleague said there should be a department to report to when you see abused patients as is done in developed countries.

R 4A said*: There should be another department that should work hand in hand with the radiology department when cases like this are brought in for radiographers.*

R 2B said*: More attention should be paid to child abuse cases so that they can be reported to the necessary authorities. Even cases of domestic violence.*

These radiographers' opinions refer to abused children and the dead. It is apparent that some of the radiographers don't like performing forensic examinations on the dead due to odours after infection Radiographers need more training to recognise abused patients who often give vague clinical histories.

(b) Forensic pathologists' perceptions on forensic radiography.

FP1 explained*: that there are delays between the time of an investigation and the reporting time. I think the long interface might be result of their reluctance to perform these investigations.*

FP5 said*: I agree with the some of the things said earlier. At the beginning of the year 2005-2006, there was a negative attitude in the radiology department which I will blame on ignorance. The negative attitude was not expected because they primarily deal with live patients and having a dead body on the same table with living patients can be a problem. Sometimes, we had to wait until evening when the patient flow lessens to take the bodies to radiology.*

From the comments of the forensic pathologists, it seems radiographers are not used to practising forensic radiography. This can be attributed to lack of awareness or lack of training about forensic radiography.

4.3.2.2 The literature on perceptions of radiographers and forensic pathologists with regard to forensic radiography services.

There were different perceptions from participants on forensic radiography services, both for the living and the dead. A perception can be defined as the way one thinks about something using the mind and the senses.[26] The most popular perception of forensic radiography is post-mortem imaging which is used in the identification of victims, as discussed in section 2.2.1. Since the discovery of X-rays, forensic radiography has played a significant role in revealing the cause and manner of death.[4,75] In the past two decades, forensic radiography in living patients has become popular in the field of forensic medicine due to social media and television programmes.[72] Dating back to the 17th Century, traditional autopsy has a long history in both clinical and medico-legal settings in revealing the cause and manner of death. More recently, new fields have emerged such as toxicology, odontology and radiology, which enhance diagnostic efficiency and complement autopsy findings.[153] Forensic radiography has gained worldwide acceptance in the field of forensic medicine. In developed countries such as Switzerland and Japan, forensic radiography has been integrated as a routine procedure before autopsy.[63] There have been many complaints from religious bodies and the public about traditional autopsy and agitation for alternative methods such as forensic radiography have been suggested.[23,72] This is line with participants' comments that forensic radiography is about the dead. R1A said that it is normal to X-ray dead bodies, but at times the bodies smell and are lacerated which can cause difficulties in positioning. Hence, additional views may be needed and images must be produced with technical standards high enough to be admitted as evidence in a court of law.[9] According to SCoR and IAFR, every radiography examination could be forensic in nature and should be of high diagnostic value.[10] In a study conducted by on living and dead forensic patients in emergency departments, it was recommended that every trauma patient should be treated as forensic unless proven otherwise.[22] In their study, dead forensic patients in emergency are dead on arrival while living forensic are victims of child abuse, gunshot and trauma cases.[22] However, radiographers attends to a lot of living non-accidental, child abuse, trauma and gunshot cases routinely without knowing they are

forensic in nature. However, imaging has been playing critical roles in resolving these cases both locally and globally.[9,12] This can be related to the comment by R 5B *I once attended and did CT for a living patient and saw cocaine in the images but I don't know if this is forensic. When making reference to the victims of trauma and child abuse that radiographers attend to on a daily basis "there should a separate department to report to when radiographers suspect such in a patient and the need for a law that will guide the processes to be followed.*

4.3.3 Responses to "What do you consider to be the responsibilities that should be included in the radiographers' role as a member of a forensic team?"

This was the third question presented to both the radiographers and the forensic pathologists. In analysing their responses, three codes were identified. In relation to these codes, one category was identified to embrace the three codes, which are presented in Table 4.3.

Table 4.3: Codes and categories related to the third question

Identified codes	Categories
Produce images Dependent Decision	Roles of radiographers in forensic team

4.3.3.1 Participants views on the role of radiographers on forensic teams

Both participants presented the same views that radiographers have roles to play on forensic teams. As done previously, the radiographers' views will be presented first followed by those of the forensic pathologists. A literature review on this question will also be presented.

(a) From the radiographers' narratives:

R1A is of the opinion that: *Our roles should not be limited to taking good images alone- we can advise the team on additional views and positioning. Although, we have not been invited to go to court with the forensic team to present evidence.* R2A said*: Radiographers should not be limited to taking the images. They might be needed to tell the story behind the image since they are the ones who perform the forensic examinations on the body.*

R3A said: *we should not act as subordinates, Radiographers should be able to advise and take decisions as a member of the team.* R7A is of the view that Nigerian forensic pathologists will not allow radiographers to make their own decisions during forensic radiography. The radiographers further *said they do not want to be treated as subordinate when in normal clinical settings.*

From the above narratives, it can be deduced that radiographers are aware of their responsibilities as well as their need to be involved in forensic imaging. It is apparent that radiographers feel undermined and underutilised. They expressed the view that they can contribute more than they are currently providing.

(b) From the forensic pathologists' opinions

The forensic pathologists expressed their views about the role of radiographers in forensic investigations.

FP3 said: *The role of the radiographer is to produce images of high diagnostic value that can be used to support or complement autopsy findings*.

FP5: *referred to normal clinical radiography where radiographers obtained high diagnostic images and radiologists reported the images, and said the same process must be followed.*

Based on the views of the forensic pathologists they wanted radiologists and radiographers to work together so that optimal results can be achieved. Although they wanted radiographers to assist radiologists in matters relating to forensics in the living and dead, there is presently no training available in Nigeria on forensic imaging for either radiographers or forensic pathologists.

4.3.3.2 Literature on the role of radiographers on forensic teams.

As defined in section 3.4.2.1, radiographers are medical personnel who dispense radiation in order to produce images of internal organs in the body for diagnostic, forensic and therapeutic purposes.[9,154] There are three established competency standards namely: high quality diagnostic images; knowledge of ionizing radiation and sound in clinical judgement. These are used by radiographers to assist medical practitioners in the management of clinical and forensic conditions.[131] Based on this definition, radiographers should comply with the relevant regulations on the use of ionizing and non-ionizing radiation, which means that justification must be made before any forensic examination of either the living or the dead.[10] In a study conducted by Schneider et al. on forensic radiographers as a members of medico-legal teams, the authors explained that radiographers play important roles in post-mortem imaging by routinely performing forensic radiography examinations prior to conventional autopsy.[24] In the study, it was found that radiographers advised the forensic teams on additional views to be taken to produce images of high quality that could be used in court of law. This relates to the R1A comment in which it was stated that *radiographers should not be limited to taking only good images.* The radiographer further said*, we can advise the team on additional views and positioning. Although, we have not been invited to go to court with the forensic team to present evidence.* R2A said: *As radiographers we should not be limited only to taking images. They might be needed to tell the story behind the image since they are the ones that performed forensic examinations on the body. They should be able to go to court. Radiographers have created standardised protocols in performing forensic examinations under the supervision of a radiologist.* This can be related to FP5, *who referred to normal clinical radiography where radiographers obtained high diagnostic images and radiologists reported on the images.* FP5 *said that this same process should be followed.*

According to SCoR, every deceased should be treated as potentially infected and as a health risk to the staff performing forensic radiography examinations. Radiographers should put

appropriate measures in place to protect public and themselves from cross infection when delivering forensic radiography services.[10]

4.4 RESPONSES TO "How do you feel about performing forensic radiography examinations on the dead or living individuals?''

This question was presented only to the radiographers. In the analysis of their responses, four codes were identified. These spoke on the radiographers' attitudes towards the performance of forensic radiography examinations and are presented in Table 4.4 below.

Table 4.4: Codes and categories related to the fourth question

Codes	Categories
Smelling Brain tasking Careful Reluctant	Attitude about forensic radiography

Some radiographers allayed their fears about forensic radiography examinations.
R1A said: *At times the pathologists will bring in dead patients smelling and lacerated to the department. I feel bad and reluctant about it. I would be comfortable if this could be performed in the morgue with adequate equipment.* R1B *is of the same view that: the morgue should be equipped to make the work easier.*

As stated by R1A, *It is brain tasking when performing forensic radiography examinations on the dead because positioning is not easy. The radiographer further said that it can be emotional sometimes.* R2A: *You have to be careful because of infection and medico-legal issues involved.* R4A was of the opinion that *when performing forensic radiography examinations on the living, another department should be involved to work hand-in-hand with the radiology department when victims of violence are brought in.* R5A *said that there should be a department to report to when an abused patient is seen.* R5B*: We attend to many living patients every day, but don't know if they are forensic in nature, like abused patients.*

From the radiographers' narratives, it seems they have some concerns about forensic radiography. If these concerns were addressed, their attitudes might change. The following

section focuses on the literature reviewed on radiographers' attitudes towards forensic radiography.

4.4.1 Literature on responses to "How do you feel about performing forensic radiography examinations either on the dead or the living"

For any radiography examinations to be carried out either on the living or the dead, the benefit must outweigh the risk and the ALARA principle must be ensured.[155] In a study conducted by Viner, on forensic medical investigation, it was found that some radiographers were reluctant to perform forensic radiography examinations on the dead.[13] This is related to a study which investigated the role of radiographers as members of forensic teams. Some 40% of radiographers pulled out of their studies because of medico-legal and psychological effects of working on the dead.[24] This also related to two participants' comments.

The second issue raised was performing forensic radiography on living patients. As discussed in section 2.4, studies have shown that parents and guardians present ambiguous clinical histories about non-accidental injuries such as child abuse when they come to the radiology department. Lack of recognition by the radiographers of these patterns of fractures which are shown on their images is detrimental to the victims, who fail to get justice.[76,78] This relates to the comment on living forensic patients by R5A*, who said that there should be a department to report to when an abused patient is seen,* and the comment of R5B who stated that as radiographers, *they attend to many living patients every day but do not know which of these are forensic patients.*

4.5 RESPONSES TO "How do you feel about the quality of forensic radiography examinations performed on living and dead individuals?"

This question was presented only to the forensic pathologists. In analysing their responses, three codes were identified. These related to two categories, as shown in Table 4.5 below.

Table 4.5: Codes and categories related to the fifth question

Codes	Categories
Reluctant	Negative attitude about forensic radiography
Inadequate	Quality of forensic radiographic images
Delay	

The forensic pathologists had noticed some negative attitudes from the radiographers during forensic radiography services and complained about delayed results from the radiographers. FP 1 said*: Delayed results are not necessary. They affect decision-making. I am used to the analogue images but from what I have seen, the quality of the images is not as good as those of the living ones. I think this might be due to the degree of penetration. These images do not last for a long time.*

FP 4 said: *There are other constraints apart from their reluctance to come; there were also delays in getting the reports to us. There used to be a processing room here but when it got bad there was a delay in moving the films to the main radiology department for processing and getting faster results.*

FP5 said: *I agree with the some of the things said earlier. At the beginning of year 2005-2006, there was a negative attitude from radiology department which I blame on ignorance. This negative attitude was not expected because they primarily deal with live patients and having a dead body on the same table with living patients can be a problem. Sometimes, we had to wait until evening when the patient flow is less to take the bodies to radiology.* FP5 further said: *The quality varies, it is a function of technique. It would be nice to have something better that can be stored in our archives for a longer period. In relation to being able to produce these images in five years, one thing that we have able to do is that we scan them, save into the system and produce CDs as our final storage copies, which enables us to store them for a long period.*

From the above narratives, it seems that the pathologists are not happy that the radiographers' results are delayed, or with the poor quality of the images. The reality on ground is that radiographers are willing to deliver the results as quickly as possible but feel that there must be dedicated equipment in the morgue to make the work easier.

4.5.1 Literature on responses from "How do you feel about the quality of the forensic radiography examinations performed on dead or living individuals?"

Quality images of living or dead forensic victims facilitates the process by which physicians or forensic pathologists extract information from the images to resolve criminal cases and identify the deceased.[10] However, the quality of these images can be affected by technical factors and accuracy in positioning.[156] As defined in section 3.4.2.1 the primary aim of the radiographer is to generate images of high diagnostic value. In a study conducted by Schneider et al., radiographers produced images of high diagnostic value to complement autopsy findings.[24] There were different opinions about the quality of images produced by the forensic pathologists in this study. FP 1 said: *the delay in getting results is not necessary. It affects decision-making. I am used to the analogue images but from what I have seen, the quality of the images is not as good as that of the living ones. I think that might be due to the degree of penetration. These images do not last for a long time.*

FP5 said: *I agree with the some of the things said earlier. At the beginning of year 2005-2006, there was a negative attitude from radiology department which I blame on ignorance. The negative attitude was not expected because they primarily deal with live patients and having a dead body on the same table with living patients can be a problem. Sometimes, we had to wait until evening when the patient flow lessened, to take the bodies to radiology. The pathologist further noted that the quality varies because it is a function of technique. "It would be nice to have something better that can be stored in our archives for a longer period. I noticed that the radiographers are not well skilled with post-mortem imaging because they have to repeat many views before we get a good radiograph.*

4.6 RESPONSES TO "Describe the teaching and learning background you have in forensic radiography?"

This question was presented to both categories of participants, who described their training in forensic radiography. As was the case with preceding sections, the analysis of data was conducted for both categories of participants. Two codes and one category were identified, and are presented in Table 4.6 below.

Table 4.6: Codes and categories related to the sixth question

Codes	Category
Limited Lack of training	Inadequate knowledge and skills on forensic radiography

4.6.1 Description of the teaching and learning received by radiographers and forensic pathologists.

As stated in section 1.7 of this study, knowledge refers to skills acquired through education and the way in which radiographers obtained their training in forensic radiography.[26] Based on this definition, the extracts below are from the transcriptions as radiographers and forensic pathologists described their teaching and learning backgrounds on forensic radiography.

(a) Radiographers' description of teaching and learning received:

The radiographer agreed that they were not knowledgeable or skilled in forensic radiography, especially in the area of post-mortem imaging.

We have been faced with a lot of challenges in forensic radiography due to inadequate knowledge said R1B*. I had to learn on the job. No previous experience in school. I learnt from my senior colleagues.*

R2A said*: It is something I just stumbled on. No training from school".*

R3A*: Since we are expected to be jack of all trades, I had to learn about forensics on my own, without training.*

R6A confirmed: *There is no teaching programme in forensic radiography in Nigeria.*

R4A*: There are complaints from forensic pathologists about our images. I attribute this to lack of training in forensic radiography.*

R1B said*: I had undergraduate experience in school where we were introduced to it in class, and I had my first practical experience during my holiday clinical posting.*

R2B*: Forensic radiography was introduced to us as part of radiography procedures during undergraduate studies, but not extensively, and I did not have any clinical experience from school.*

R4B said: *We were taught it as a topic in a course, but it was not as expanded on as other topics in radiography are.*

During my undergraduate days in school, said R5B*, there were no teaching and learning programmes in forensics. It was not part of our curriculum. Hence, there is need for such*

training in radiography so that radiographers can specialise in the field of forensic radiography. Based on these descriptions of the teaching and learning as presented by radiographers, it is apparent that there has been a lack of training. This has hampered the forensic services provided. There is need for radiographers to use forensic radiography as an alternative to conventional autopsy, in some cases due to cultural and religious reasons.

(b) Forensic pathologists' description of their teaching and learning received:

FP3 said: *Radiographers in Nigeria are trained primarily to attend to live patients. However, they are expected to have adequate knowledge on dead patients as well.*

With regard to expertise, FP5 said*, I personally noticed that the radiographers are not well skilled with post-mortem imaging because they have to make many repeat views before we get a good radiograph.*

FP1 said: *In my interactions with radiographers after the plane crash, I observed that they were unwilling to participate in forensic radiography of the dead, which can be attributed to inadequate knowledge."* Based on the above descriptions provided by the forensic pathologists, radiographers lack the knowledge and skills to perform forensic examinations. Policymakers should organise regular training in post-mortem imaging for those interested.

4.6.1.1 Literature on "Describe the teaching and learning background that you have had in forensic radiography and forensic medicine."

In Nigeria, forensic radiography is a relatively new and specialised area in the field of forensic medicine, that brings science and the law together.[10] It must be practiced by skilled and experienced radiographers who are knowledgeable on the appropriate imaging modalities and protocols used.[10]

According to SCoR and the IAFR, radiographers must have postgraduate qualifications to perform forensic radiography examinations.[10] They must also have adequate knowledge and experience on the appropriate imaging techniques; non-accidental injuries radiography; medico-legal issues; the local health and safety regulations on deceased people; the different cultural and religious ethics associated with the deceased; good communication skills for dealing with subjects who have undergone traumatic experiences; and knowledge of the guidelines relating to radiography for forensic purposes.[10] In a study conducted, it was

reported that no training for forensic professionals exists in Nigeria despite there being a need for radiographers to be trained and produce images of quality.[1] In another study conducted by Kadlas[9] in USA showed that radiographers performing forensic radiography examinations had learn on the job without training from school. This relates to the participants' comments: We have been face-to-face with a lot of challenges in forensic radiography due to inadequate knowledge," and (R1B) *I had to learn on the job. No previous experience in school. I learnt from my senior colleagues.* (R2A) *It is something I just stumbled on. No training from school*. And R3A*: Since we are expected to be jack of all trades, I had to learn about forensics on my own without training*. Having related the descriptions of teaching on the subject of forensic radiography, the following section addresses the seventh question asked.

4.7 RESPONSES TO "What are your recommendations as a radiographer or forensic pathologist towards forensic radiography education in Lagos state, Nigeria?"

In concluding the focus group interviews, the final question was directed to both the radiographers and forensic pathologists. Analysis of the data collected from the radiographers and the forensic pathologists resulted in the identification of two codes and two categories. These are presented in Table 4.7 below.

Table 4.7: Codes and categories for the seventh question

Codes	Category
Specialty	Training in forensic radiography
Morgue	Equipment

As in the case of the preceding questions, the recommendations from radiographers are given first followed by those of the forensic pathologists. In an attempt to determine whether the results of this study support the findings of previous studies and present new information.

4.7.1 Recommendations for forensic radiography education in Lagos state, Nigeria

From the analysis of data, it was evident that both the forensic pathologists and radiographers emphasised the issue of undergraduate and postgraduate training in radiography curriculum. The radiographers further suggested that forensic pathologists should be trained the area of post-mortem imaging**.**

(a) Recommendations by radiographers:

R1A said*: should be included in the undergraduate curriculum as an introduction to forensic radiography.* R4A*: I think undergraduates should be given introductory classes on post-mortem imaging, and a post graduate course should be introduced as a specialisation.* R5A said*: Students can be posted to forensic pathology departments that have imaging modalities and equipment, to learn the basic skills during their clinical posting, and* R1B said: *There should be a certification course on forensic radiography and the scope should be widened at undergraduate level to improve basic knowledge.* R3B said: *Doing these examinations regularly on the dead will help us to know what to do, and will better serve the next body examination.* In assessing radiographers on the quality of images produced during forensic radiography examinations, it is apparent that radiographers are capable of producing images of high diagnostic value for the dead. However, the imaging equipment must be upgraded and working optimally. The following section focuses on recommendations made by the forensic pathologists.

(b) Recommendations by the forensic pathologists:

The forensic pathologists advocated adequate training for radiographers in forensic radiography, especially in post-mortem imaging.

FP2 said: *Since this is highly skilled specialty I think it should be studied at undergraduate level. There could be an introductory course on it to steer the interest.* FP1 said: *"The government should invest in training all cadres of staff, including radiographers, who take an interest in forensic radiography. A specialty should be created for radiographers who are interested in the field. There should be awareness about forensic radiography and it should be introduced at postgraduate level for interested radiographers.*

FP 3 said*: I am not sure how robust postgraduate courses in radiography are in Nigeria. I think forensic radiography should be included during the internship year after graduation, when students should be rotated in the forensic pathology department.* FP 5 said:

forensic radiography should be thought of at postgraduate level because it should be specialisation, as it is in the developed world.

The above extracts from recommendations made by the forensic pathologists together with those made by the radiographers in the preceding paragraphs is related to literature in the following section.

(c) Bringing together radiographers' and forensic pathologists' recommendations:

As shown in Table 4.7above, issues of concern focused on education and training in forensic radiography, and the availability of equipment. Both forensic pathologists and radiographers talked about government intervention in forensic investigation. The radiographers raised concerns about adequate funding and regular training for professionals involved in forensic teams.

R5A said: *I would appreciate a dedicated unit for forensics to avoid any cross-contamination of infection.*

R1B said: *In my own opinion, the morgue should have its own mobile machine and all other accessories including cassettes, gowns, gloves and face masks. R4B said: In addition to that, I think the morgue should have their equipment operated by radiographers, and not by the autopsy technicians.*

The forensic pathologists said that adequate equipment and additional training would help to improve forensic radiography in Nigeria.

FP4 said*: Improving forensic radiography is tied to improving forensic study both in this state and countrywide. It would entail every forensic pathology department having their own imaging modalities. This would make government funding very important.*

FP5 said: *I would appreciate having a centre for forensic imaging where all professionals involved in forensics could work together to unveil causes of death using adequate equipment.*

Based on the above submissions it is clear that government is requested to provide adequate equipment for forensic purposes and that pathologists in Lagos state are more involved with the death than living forensic patients. However, they can be involved in carrying out forensic examinations on living forensic patients if they are called to do so.

4.7.1.1 Literature review on recommendations for forensic radiography education in Lagos state, Nigeria.

Forensic radiography is a specialised area in the field of radiography which must be practised with high level of professionalism. In a study conducted by Elliot et al., it was found that certification programmes should be organised for radiologists, radiographers, and forensic pathologists who conduct post-mortem examinations.[42] This is in line with documents written by SCoR and the IAFR that radiographers must be educated at postgraduate level with regular and continuous professional development in order to perform forensic radiography examinations.[10]

This relates to participants comments such as In my own experience R4A *I think there should be introductory class in undergraduate and post graduate course should be introduced as a specialization* (R4A), *and Forensic radiography should be thought of as a postgraduate level because it should be a specialisation, as it is in the developed world* (FP5).

According to SCoR and the IAFR, referring teams such as forensic pathologists, odontologists, anthropologists, physicians and the police and security services must be knowledgeable regarding the appropriate examinations when requesting examination of the living or the dead and forensic radiographers must be sufficiently skilled to operate different imaging modalities that can be used to answer questions related to law.[10] In their documents it was recommended that forensic examination of the dead must be performed in an adequately equipped mortuary with appropriate imaging modalities. This can be relates to the comment made by R5A*, who said: I would appreciate a dedicated unit for forensics to avoid cross contamination of infection in the radiology department*. FP5 said*: I would appreciate having a centre for forensic imaging where all professionals involved in forensics work together to unveil cause of death with adequate equipment.*

Having presented the results in terms of codes and categories and related the categories to the literature, the following section looks at the development of themes.

4.8 THE EMERGING THEMES

After relating the results to the literature, the researcher now presents the concepts, factors and themes that emerged from the research. According to Gray, Grove and Sutherland, a

theme represents study results in a phenomenological or exploratory descriptive study. These authors further describe the theme as the merged codes/categories, especially where these are seen to be repetitive in the study. They are identified through an inductive process.[38]

The theme is also defined as a total reflection of the study data. As stated in the introductory section of this chapter, both the radiographers and forensic pathologists were taken as the unit of analysis.[145] Five themes emerged in this study, as presented in Table 4.8 below.

In the following chapter, the five themes are correlated with the research objectives to reveal the study findings.

Table 4.8: Themes that emerged in this study

THEMES	**CATEGORIES**
1. Experiences of forensic radiography	Perceptions of forensic radiography Negative experiences of forensic radiography Lack of dedicated forensic radiographic infrastructure and equipment Poor quality of forensic radiographic images Delay in getting forensic results and reports
2. Knowledge of forensic radiography	Inadequate skills and knowledge of forensic radiography
3. Attitudes towards forensic radiography	Negative attitudes to forensic radiography
4. Radiographers' role in the forensic team	Radiographers' responsibilities Total involvement in forensic investigations Member of the forensic team
5. Recommendations to improve forensic radiography	Ensure adequate forensic radiographic equipment and infrastructure Training in forensic radiography (introduction at undergraduate level, and postgraduate speciality training) Ensure support in cases of suspected abuse

4.9 CONCLUSION

The results from radiographers and forensic pathologists were presented in this chapter. Both radiographers and forensic pathologists were used as the unit of analysis. This was based on the fact that they were asked similar questions and their responses to the questions were similar. These responses were justified through the presentation of direct narratives from the transcribed data. A literature review was related to each of the identified categories. At the end of this chapter, the five themes that emerged from the study were presented in Table 4.8, namely, a) experiences of forensic radiography, b) knowledge of forensic radiography, c) attitudes to forensic radiography, d) the radiographers' role in a forensic team; e) recommendations for improvements in forensic radiography. In the following chapter these themes are interpreted and related to the research objectives.

CHAPTER FIVE: INTERPRETATION OF THE EMERGING THEMES

Success is no accident. It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing.

Pele.

5.1 INTRODUCTION

In the previous chapter the study results were presented in accordance with the questions asked during the focus group interviews. The presentation of results further provided clarity as to how the categories and themes emerged from the data analysis process. This chapter focuses on the interpretation of the themes. According to Gray, Grove and Sutherland, interpretation of themes is one of the most important parts of qualitative research.[38] These authors describe interpretation as translating the words and actions of participants into meanings that readers can understand. This is supported by Denzin, who stated that interpretation of themes is the act of presenting the participants' in-depth information in a meaningful and understandable way.[124] This is in line with Denzin et al., who reported that in-depth information must reflect the participants' deep experiences in the study area.[157]

The five emergent themes are: a) experiences of forensic radiography; b) knowledge of forensic radiography; c) attitudes to forensic radiography; d) radiographers' role in a forensic team; e) recommendations for improvements in forensic radiography.

5.2 relationship between emerging themes and research objectives

Relating the themes to the research objectives was found to be important as it allowed the researcher to ascertain that the emerging themes addressed the research aim and objectives. The study's aim was to explore and describe the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding forensic radiography services. Table 5.1 below shows how the themes address the respective research objectives. As shown in the table, some of the emerging themes address more than one research objective.

5.1: How the emerging themes address the research objectives

Research objectives	Themes
❖ To explore the experiences, attitudes and knowledge of radiographers and forensic pathologists in Lagos state, Nigeria with regard to forensic radiography services	➢ Experiences of forensic radiography ➢ Knowledge of forensic radiography
❖ To describe the reasons behind radiographers' being reluctant to perform forensic radiography services in Lagos state, Nigeria.	➢ Attitudes towards forensic radiography ➢ Radiographers' role in the forensic team ➢ Recommendations to improve forensic radiography

5.2.1 Relating research objective one to the Emerging themes

Objective one: To explore the experiences, attitudes and knowledge of radiographers and forensic pathologists in Lagos state, Nigeria regarding forensic radiography services. Objective one related to two themes, namely: experiences and knowledge of forensic radiography. The experiences of participants with regard to forensic radiography services were explored first, followed by the knowledge of radiographers and forensic pathologists with regard to forensic radiography services.

5.2.2 Interpretation of participants' experiences in forensic radiography

Experience was the first theme that emerged from the discussion of the categories identified following the analysis of data collected from all focus groups interviews. In the study, the

participants in each of the focus group interviews related their challenges regarding forensic radiography services. The researcher extracted positive and negative experiences from the participants' narratives in the study. It is important at this stage to explain the meaning of experience in the study. It is the way in which participants perform forensic radiographic examinations, or is experienced in terms of observing the examinations being performed.[27] From the focus group interviews, the researcher ascertained that radiographers are not well skilled in post-mortem imaging due to the challenges faced when delivering forensic radiographic services in Lagos State. Though, this cannot be generalized. The forensic pathologists also complained that radiographers are not well skilled in post-mortem imaging. These comments relate to a study conducted by Elliot et al. which found that the majority of resident radiology doctors in the UK are not skilled in post-mortem imaging.[42] It also concurred with a Nigerian study conducted on post-mortem imaging, which found that radiologists in the study had limited experience in the area of post-mortem imaging, which caused discrepancies in the results.[23] Studies conducted have shown that radiographers who performed forensic radiography examinations complained about the environmental challenges, post-traumatic disorders, emotional responses, and psychological impacts they encountered when delivering forensic radiography services.[24,55,116,158] This relates to radiographers' experiences in forensic radiography. R4A said: *In 2013 during my internship, there was a plane crash and bodies were brought in. I was concerned about the physical and emotional challenges faced in that situation and further said positioning of the bodies was not easy and that the image processing was stressful. Not all the radiographs were adequate. It was my first time doing forensic radiography. I had no experience, which I attribute to the lack of training in forensic radiography at school.*

This was echoed by R2A: *My experience in forensic radiography was during the DANA crash. Even after two weeks they were still bringing in bodies and most times these bodies were in pieces and decomposing. It was a really disturbing period. The work was tedious and we had to leave late, at about 9-10pm, and the positioning was difficult since bodies cannot take instructions. The pathologists kept on pressuring us to be fast, without considering the constraints and sometimes these bodies were brought in during the day, affecting the live patients. We then had to make arrangements for the bodies to be brought in during call hours.*

5.2.3 Interpretation of participants' knowledge of forensic radiography

Knowledge in this study refers to the training of the participants in forensic radiography, either for the living or the dead,[26] but following analysis of the data, it became clear that the question on knowledge was understood differently by the participants. Based on the question "what comes to mind when you hear the word forensic radiography?" most of the participants mentioned dead patients. Only few said child abuse, trauma cases and body packing. This refers to their level of knowledge and perceptions of forensic radiography. As discussed in section 1.7, knowledge in this study is the way that the participants acquired skills and training in forensic radiography examinations. Both set of participants agreed on the need for training in forensic radiography. Most of the radiographers had a good background in trauma imaging, indicating work done on living forensic patients. However, they commented that participation in this study had shown them that although they attend to many living forensic patients, they had no adequate training in helping victims of abuse to get justice, and that this lack of recognition was detrimental.[107] This agreed with studies showing that radiographers who mainly attend to living forensic patients have inadequate training on the medico-legal principles of forensic investigation.[13] The radiographers said they had to learn forensic radiography on the job. R1B said: *We have been faced with a lot of challenges in forensic radiography due to inadequate knowledge. I had to learn on the job, with no previous experience in school. I learnt from my senior colleagues.* This narrative is in line with the study findings of Kadlas et al., that radiographers in the USA performed forensic radiography examinations without training but learnt on the job.[9] The participants in this study suggested that forensic radiography should be a specialised field and that an undergraduate course should be introduced with specialisation at postgraduate level, as is done in the developed world. This statement concurs with the IAFR and SCoR guidelines that any radiographer that wants to perform forensic radiography examinations must have a post-graduate qualification.[10]

5.3 RELATING RESEARCH OBJECTIVE TWO TO THE EMERGING THEMES

To describe the reasons behind radiographers being reluctant to perform forensic radiography examinations in Lagos state, Nigeria. In line with objective two, three themes emerged, namely: attitudes towards forensic radiography, the radiographers' role in a forensic team,

and recommendations to improve forensic radiography. Attitude towards forensic radiography is discussed first.

5.3.1 Interpretation of attitudes towards forensic radiography

The forensic pathologist complained about the negative attitude of radiographers towards post-mortem imaging. They further said that radiographers are not willing to perform post-mortem imaging because they are not trained for such work. FP5 said: *One of the forensic pathologists has stated that there are delays between the time of investigation and the reporting time. I think this might result from their reluctance to perform these investigations. At the beginning of year 2005-2006, there was a negative attitude in the radiology department which I blame on ignorance. The negative attitude was not expected because they primarily deal with live patients and having a dead body on the same table with living patients can be a problem. Sometimes, we had to wait until evening when the patient flow was less to take the bodies to radiology.* These words are in line with studies conducted by Viner et al.[13] and Schneider et al., that radiographers are reluctant to perform post-mortem imaging due to the psychological effects and medicolegal issues involved.[24]

5.3.2 Interpretation of radiographers' role on forensic teams

Based on the definition of radiographers in section 3.4.2.1, radiographers are medical personnel who dispense radiation to produce images of internal organs in the body for diagnostic, forensic and therapeutic purposes. [9,131]

According to SCoR and IAFR, radiographers who perform forensic radiography examinations on either the living or the dead must comply with the safe and efficient use of ionizing and non-ionizing radiation and must adhere to local protocols.[10] Therefore, radiographers must adhere to the ALARA principle to protect themselves and the public when dispensing radiation for forensic purposes. Due to their knowledge of anatomy, patient positioning and patient safety, radiographers have expertise in trauma imaging. They therefore play a vital role on a forensic team. In a study conducted by Walsh et al. on mass graves and emergency situations, radiographers screened the dead bodies and assisted in the location and removal of bullets.[115] In the same study, it was found that radiographers produced images of high quality for identification purpose. This relates to the comments of FP1 and FP5 who said that

the role of a radiographer is to produce images of high quality, as is normally done in clinical settings. In another study conducted by Schneider et al. on forensic radiographers as new members on medico-legal teams, it was reported that these radiographers advised the forensic team on the appropriate technique to use in producing images of high quality for medicolegal cases.[24] In so doing, this reduced the work of the forensic pathologists when routinely performing forensic radiography examinations.[24] This accords with the R1A comment that: *In my opinion, we should not be limited to taking good images. We could advise the team on additional views and positioning.*

5.3.3 Interpretation of recommendations to improve forensic radiography services

Objective two was to describe the reasons for radiographers' reluctance to perform forensic radiography examinations. As discussed in section 2.2, despite the contribution of forensic radiography to forensic medicine in the 21st Century due in part to terrorist attacks and non-accidental injuries, there are still worldwide challenges with its acceptance, funding and training of personnel. According to SCoR and IAFR, radiographers must have postgraduate qualifications to perform forensic radiography examinations, and there must be dedicated equipment for forensic radiography in morgues or radiology departments.[10] This relates to the comments of R4A: *In my own experience, I think there should be introductory classes in undergraduate and postgraduate courses that should be introduced as a specialisation.* Another participant, FP5 said: *forensic radiography should be thought as a postgraduate level because it should be an area of specialisation as it is in the developed world.*

5.4 RESEARCH FINDINGS

When interpreting explorative and descriptive design, all research questions in a study must be answered by the researcher and be reflected in the findings.[44] Traditionally, forensic radiography is carried out on both the living and the dead by radiographers in an imaging department or morgue, on the request of a recognised forensic practitioner, such as a forensic pathologist. This relatively new field in forensic medicine plays a vital role globally in identification of the deceased and in resolving non-accidental injury cases such as child abuse. Despite the success recorded by forensic radiography and radiographers in the new millennium as discussed in section 2.3, it still faces many challenges such as funding,

education and staff training, equipment, and acceptance in the courts of law, while religious bodies and the public still clamour for an alternative method to conventional autopsy.
This study has explored the experiences, attitudes and knowledge of forensic pathologists and radiographers regarding forensic radiography services in Lagos state. The findings of the study are discussed below.

5.4.1 Forensic radiography is being performed by radiographers and utilised by forensic pathologists.

Radiographers in Lagos state, Nigeria, perform forensic radiography examinations both on living and dead forensic victims on the request of physicians and forensic pathologists. Based on the information given by radiographers in their focus group interviews, radiographers in Nigeria perform forensic radiography examinations using their clinical experience and knowledge of technique, but do not have specific training in forensic radiography. This is similar to the U.S.A situation, where radiographers learn forensic radiography on the job, without proper training.[9] This is contrary to the guidelines recommended by SCoR and IAFR, that radiographers performing forensic radiography examinations must have postgraduate qualifications in forensic radiography and must regularly attend training in forensics.[10] The forensic pathologists who took part in this study were of the opinion that there should be appropriate education and training programmes for radiographers in forensic radiography in order to improve the quality of services delivered.

From the study narratives, it is apparent that radiographers contribute to forensic medicine, but they need to be involved in all the activities surrounding the care of forensic patients. Policymakers in the field of radiography must formulate training programmes for radiographers who are interested in performing forensic imaging, as is done in the developed world.

5.4.2 Radiographers and forensic pathologists respect each other during mass disaster

As discussed in section 2.8 for a previous study conducted on mass disaster emergencies, it was reported that forensic pathologists respect radiographers carrying out forensic radiography on the dead.[116] This is unlike in normal clinical practice, where radiologists see radiographers as subordinate, as stated by the participants. Forensic pathologists generally

have mutual respect for radiographers but want them to change their attitude towards forensic radiography, especially in the area of autopsy. It is evident that with proper communication with the heads of radiology, radiographers play a vital role in improving the quality of services in forensic radiography.

Despite the complaints expressed by radiographers and forensic pathologists about each other's attitudes toward forensic radiography services, the two professions communicated well with each other to deliver forensic radiography services in Lagos state during the mass disasters.

5.4.3 The need for infrastructure and dedicated equipment for forensic radiography

Given the responses by radiographers and forensic pathologists in the study interviews, the need for infrastructure and dedicated equipment for forensic radiography services in Lagos state is evident, particularly due to its geographical location and social vulnerability. As discussed in section 2.2.4, several mass disasters occurred in Lagos, where dedicated forensic radiography equipment was needed to produce the quality and timely results requested by the attending forensic pathologists. Dedicated equipment is also needed in the normal course, to help reduce the transmission of disease in the State.

5.5 CONCLUSION

In this chapter, the themes that emerged from the focus group interviews were revealed and used to address the objectives and findings of the study. The study findings emanated from the experiences of the focus group interviews regarding forensic radiography services. The literature was used to support the shared experiences of the participants. This involved the use of inductive reasoning which is at the core of the qualitative research approach. Forensic radiography has played a vital role in identification of the deceased. It has revealed non-accidental injuries in living patients and cocaine concealment. Although full acceptance of forensic radiography by the courts, religious bodies and the public is largely influenced by factors such as funding, dedicated equipment, and staff training, which improve the quality of health services delivered, the ultimate goal of qualitative research is to explore, describe experiences and gain a deeper understanding of the study area and the challenges faced by the participants in normal settings.

CHAPTER SIX: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

In Chapter five, the researcher presented the interpretation of the emerged themes in detail and related them to the aim and objectives of the study. In this chapter, the study limitations and recommendations are presented, followed by the conclusions.

6.2 LIMITATIONS

It is international practice that researchers should state the limitations faced in a research project and how they were addressed.[159] The limitations in this study are stated below:
The study managed to attract only five forensic pathologists employed in Lagos State University Teaching Hospital. They were the only ones who were available and gave their consent to participate. However, the researcher gathered in-depth information from them and they described their experiences in forensic pathology. The researcher was a novice in conducting focus group interviews which could have affected the narratives analysed. To mitigate this limitation, the researcher trained under the guidance of co-supervisor on how to conduct focus group interviews. The presence of a research assistant was also valuable in this case, for taking the field notes and managing the recording while the researcher was conducting the interviews. As previously mentioned, the interviews took place in two government-owned tertiary teaching hospitals in Lagos because of the intention to conduct the interviews where the respondents felt familiar and comfortably able to explore their experiences and perspectives on the subject of forensic radiography.

The researcher faced some challenges at the beginning of the radiographers' focus group interviews because some of the radiographers spoke very quickly and sometimes more than one participant spoke at the same time. The researcher managed to control the situation as the interviews progressed and the research team went through the audio-recordings while examining the field notes to ensure that no responses had been overlooked.

As indicated, the researcher ensured that none of these limitations impacted on the study findings or the quality of the collected data. It should be noted that most of the studies conducted in Nigeria on mass disasters and forensic imaging do not focus on the experiences of forensic radiographers, but concentrate on the experiences of forensic pathologists and radiologists. This study is the first, according to the researcher's knowledge, to focus on forensic radiographers in Nigeria.

6.3 RECOMMENDATIONS

Forensic radiography is a new field in Nigeria with many challenges such as training of personnel and availability of dedicated equipment. This research project has been of great interest to the researcher and the forensic radiographers. Recommendations that can guide further studies in the field of forensic radiography are shown below.

It is recommended that the existing law in terms of coroners in Lagos state should be amended to include the roles and responsibilities of radiographers as members of the forensic team. This was highlighted by the radiographers who took part in the study.

Radiographers working in radiology departments who attend to living patients and dead forensic patients in their clinical practice should update their knowledge and skills in recognising forensic patients. Radiographers should be aware that it is their responsibility to produce images of high quality that can be used in the court of law.

Forensic radiography should be introduced into the undergraduate radiography curriculum as well as an area of specialisation at postgraduate level as is done in the developed world. Introducing this as a specialty will help cater for the currently qualified radiographers who did not get training during their undergraduate programmes. Further studies should be conducted on how to develop a curriculum in forensic radiography for forensic professionals.

The Nigerian government should establish disaster victim identification teams of forensic professionals who must work together during mass disasters. Government must also support the development of forensic protocols and fund forensic radiography by providing, among other things, dedicated imaging equipment to the morgues.

Radiographers should be educated to suspect child abuse when presented with vague clinical histories and should endeavour to produce images of high quality that can be documented, preserved and serve as evidence in the courts of law to assist in the prosecution of perpetrators.

Radiographers should be rotated through forensic pathology departments and perform forensic radiography examinations of the dead during their one-year compulsory internship. This may improve their attitude towards performing radiography examinations on the dead for forensic reasons.

6.4 CONCLUSION

The research questions and problem statement that led to this research have been extensively addressed. What are the experiences, attitudes and knowledge of radiographers and forensic pathologists with regard to forensic radiography services in Lagos state? Why are radiographers in Lagos state, Nigeria reluctant to perform forensic radiography examinations? The interpretation of the emerging themes in relation to the research objectives ensured that the following objectives were fully addressed: to explore the experiences, attitudes and knowledge of radiographers and forensic pathologists in Lagos state, Nigeria regarding forensic radiography services and to describe the reasons behind radiographers being reluctant to perform forensic radiography services. Finally, recommendations on how forensic radiography services can be improved were provided. The researcher is of the view that the recommendations made by participants must be taken into consideration and feels that the aims and objectives of the study, which were to explore and describe the views of radiographers and forensic pathologists regarding forensic radiography services has provided a baseline for future educational programmes and the preservation of evidence for judicial purposes. Thus, the purpose of the study has been achieved.

REFERENCE LIST

1. Obafunwa J.O, Faduyile FA, Soyemi SS, Eze UO, Nwana EJ Odesanmi WO. Forensic investigation of mass disaster in Nigeria. Niger J Med. 2015; (56):1-5.
2. Grabher S, Baumann P, Minoiuc C, Fahrni S, Mangin P. Post-mortem imaging in forensic investigations: current utility, limitations, and ongoing developments. Research and Reports in Forensic Medical Science 2016:(6) 25-37
3. Thomas, AMK, Banerjee K. The history of radiology. Oxford: Oxford University Press; 2013.
4. Elifritz JM, Nolte KB, Hatch GM, Adolphi NL, Gerrad C. Postmortem forensic pathology & forensic radiology. University of New Mexico, Albuquerque USA. Elsevier; 2014.
5. Doyle E, Marquez-Grant N, Field L, Holmes T, Arthurs OJ, van Rijn R. Guidelines for best practice: Imaging for age estimation in the living. J Forensic Radiol. Imaging. 2019 Feb; (16)38-49.
6. Hobbs CJ, Bilo, RA. Non-accidental trauma: clinical aspects and epidemiology of child abuse. Pediatr Radiol. 2009; 39(5):457-460.
7. Australian institute of health and welfare, A.I.H.W Child protection Australia Child welfare series. [Online]. Available from: www.aihw.gov.au/publication [Accessed 10 Dec 2019]
8. Hulson OS, van Rijn RR, Offiah AC. European Survey of imaging in non-accidental injury demonstrates a need for a consensus protocol. Pediatr Radiol. 2014 Dec; 44 (12):1557-63.
9. Kudlas M, Odle T, Kisner L. The state of forensic radiography in the United State of America. Radiol. Technol. 2010; 81(5)484-490.
10. Society and College of Radiographers and Association of Forensic Radiographer and the International Association of Forensic Radiographers: Guidance for radiographers providing forensic radiography services. London: SCoR; 2014. Available from https://www.sor.org [Accessed on 10 January 2018]
11. Lasu inaugural lecture series in diagnostic radiology. The centrepiece and hub of medicine and dentistry .52nd ed. Lagos: 2016; p.16. Available from https://lasu.edu.ng/publications/inaugural_lectures/inaugural_52th_lecture_of_professor_awosanya.pdf

Commented [MQ2]: Page number added

Commented [MQ3]: URL added

12. Arogundade RA. The role of imaging in the management of body packing of illicit drugs J. Pharm.Sci.& Pharm. Pract. 2006; 8(3&4):64-67.
13. Viner M. Radiography and forensic medical investigation. A study of forensic radiography in South Africa, Argentina and USA. 2006; p.5-6. Available on https://www.wcmt.org.uk/sites/default/files/migrated-reports/67_1.pdf
14. Dirnhofer R, Jackowski C, Vock P, Potter K, Michael J, Thali M. Virtopsy: minimally invasive imaging guided virtual autopsy. J Digit Imaging. 2006;(26):1305-1333.
15. Thali M, Dirnhofer R, Vock P. The virtopsy approach: 3D optical and radiological scanning and reconstruction in forensic medicine. New York: CRC Press; 2009.
16. Bolliger SA, Thali MJ, Ross S Buck U, Naether S and Vock P. Virtual autopsy using imaging bridging radiologic and forensic sciences. A review of the virtopsy and similar projects. Eur J Radiol. 2008; 18(2):273-82.
17. Puentes K, Taveira F, Madureira, J, Santos A, Mangalhaes T. Three-dimensional reconstitution of bullet trajectory in gun wounds: A case report. J Forensic Leg Med. 2009; (16):407-410.
18. Butchart B, Mikton C. Global status report on violence prevention. Geneva: WHO; 2014.
19. Cucu A, Daniel I, Paduraru D, Galan A. Forensic Nurs Emerg Care. Rom J Leg Med 2014 Jun; 1(22):133-6.
20. Lynch VA. Forensic Nursing Science: Global Strategies in Health & Justice. Egypt J Forensic sci. 2011; 30:1(2):69-76.
21. Pasqualone GA. The Relationship between the Forensic Nurse in the Emergency Department and Law Enforcement Officials. Crit Care Nurse Q. 2015 Jan1; 38(1):36-48.
22. Filmalter CJ, Heyns T, Ferreira R. Forensic patients in the emergency department. Who are they and how should we care for them? Inter. Emerg. Nurs. 2017.
23. Nwafor NN, Nwafor CC, Obafunwa JO, Ekpo MD. Postmortem forensic imaging: An essential tool in contentious cases. West Afr J.Radiol. 2018; 25:1-8.
24. Schneider B, Chevallier C, Dominguez A, Bruigurer C, Mangnin P, Elandoy C, Mangnin P, Grabherr S. The forensic radiographer: a new member in the medicolegal team. Am J Forensic Med Pathol. 2012 Mar; 33(1):30-6.
25. Aldous C, Rheeder P, Esterhuizen T. Writing your first clinical research protocol. 6th edn. South Africa: Juta; 2017.

26. Hogg M.A. Tindale S. Blackwell handbook of social psychology. NY: John Wiley & Sons;2008
27. Wolf J.A, Niederhauser V, Marshburn D, La Vela, S.L. Defining patient experience. J.Patient Experience 2014; 1(1):7-19.
28. Creswell JW. Qualitative inquiry and research design. Choosing among five approaches.3rd ed. Los Angeles. CA: Sage Publications; 2013.
29. Polit DF, Beck CT. Essentials of Nursing Research: Appraising evidence for nursing practice. 9th edn. Philadelphia: Wolters Kluwer; 2017.
30. Meriam SB, Tisdell EJ. Qualitative research: A guide to design and implementation. NewJersey. John Wiley & Sons; 2015.
31. Lemanski T. Overton T. Philosophy of qualitative research. The U.K higher physical education Centre. 2011.http://www.heacademy.ac.uk/physsi. Retrieved on 9 August 2017.
32. Schuliar Y, Knudsen PJ. Role of forensic pathologists in mass disaster. Forensic Sci Med Pathol. 2012;8:164-73.
33. Higginbotham-Jones J, Ward A. Forensic radiology: The role of cross-sectional imaging in virtual post-mortem examinations. Radiography. 2014;20:87-90.
34. Saldana J. The coding manual for qualitative research. Thousand Oaks, CA:SAGE. Retrieved from http://www.sage pub.com/upm-data/24614-01-Saldana-ch-01;2012.
35. Henning E, Van Rensburg W, Smit B. Finding your way in qualitative research. Pretoria: Van Schaik; 2004.
36. Polit DF, Beck CT. Nursing research: Generating and assessing evidence of nursing practice 10th ed. Philadelphia: Wolters Kluwer Health; Lippincott, Williams and Wilkins; 2017.
37. Scotland J. Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms. English Language Teaching. 2012;5(9):9
38. Gray JR, Grove SK, Sutherland S. Burns N, Grove S. The practice of nursing research. Appraisal, synthesis and generation of evidence. (8thed). St Louis, MO: Saunders Elsevier; 2017.
39. Kahlke RM. Generic qualitative approaches: Pitfalls and benefits of methodological mixology. Int J Qual Methods; 2014;13(1): 37-52.

40. Preethi S, Elinstein A, Sivapathasundharam B. Awareness of forensic odontology among dental practitioners in Chennai: A knowledge, attitude, practice study. J.Forensic Dent Sci. 2011;3:63-6.
41. Selvajothi P, Lavanya C, Joshua E, Rao UK, Ranganathan K. Awareness of forensic odontology among legal professionals in Chennai, India. North Am J.Med Sci; 2014(6):553-7.
42. Elliot CL, Arthurs OJ, Young J. Current status of UK radiology trainee experiences in post-mortem imaging: A questionnaire-based survey J. Forensic Radiol Imaging. 2017 (9): 31-35
43. Udoaga PI, Okoh DS, Egbor PE. Awareness of forensic odontology among Nigerian dentists: A knowledge, attitude & practice study. Afr J. Oral Maxillofac Path.Med. 2015; 1:51-7.
44. Grove SK, Gray JR. Understanding nursing research e-book: Building an evidence-based practice. St Louis, MO Elsevier Health Sciences; 2018. Available on https://www.elsevier.com/books/understanding-nursing-research/grove/978-0-323-53205-1
45. Ritchie J, Lewis J, Nicholls CM, Ormston R. Qualitative research practice: A guide for social science students and researchers. Sage; 2013. Available on https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/ReferencesPapers.aspx?ReferenceID=2054799
46. Liamputtong P. Focus group methodology: Principle and practice:4th ed. Oxford University Press. Sage Publications; 2011.
47. World Medical Association. WMA declaration of Helsinki: ethical principles for medical research involving human subjects. Brazil: World Medical Association;2013. Available on https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/
48. National Patient's Rights Charter. HPCSA guidelines for good practice in the health care professions. Pretoria: National Patients' Rights Charter booklet 3; 2008.
49. Butts BJ, Rick KL. Nursing ethics across the curriculum and into practice. London: Jones and Bartlett; 2013.
50. Tappen R.M. Advanced nursing research from theory practice. London:Jones and Bartlett; 2010.
51. Dhai A, McQuoid-Mason DJ. Bioethics, human rights and health law: Principles and practice. Cape Town: Juta & Co; 2010.

52. Boswell J, Cannon S. Introduction to nursing research incorporating evidence-based practice. 2nd ed. London:Jones and Bartlett; 2011.
53. Wecht C.H. The history of legal medicine. J. Am. Acad. Psychiatry and Law. 2005;33(2): 245-51
54. Starr L. Assisting victims of crime - bridging the gap from trauma to trial. Aust. J. Adv. Nurs. 2013;13(9):29.
55. Jeffery A J. The role of computed tomography in adult post-mortem examinations: an overview. Mini-Symposium: Non-Invasive Radiological Autopsy. Elsevier;2010. Available on https://www.diagnostichistopathology.co.uk/article/S1756-2317(10)00144-1/abstract
56. Britton P. Body scans instead of post-mortems. Manchester Evening News; 2008.
57. Hansard House of Commons parliamentary debate. London;2008. https://www.google.com/search?q=Hansard+House+of+Commons+parliamentary+debate.+London%3B2008&oq=Hansard+House+of+Commons+parliamentary+debate.+London%3B2008&aqs=chrome..69i57.11942j0j15&sourceid=chrome&ie=UTF-8
58. Rutty GN Alminyah A, Calla A, Elliott D, Fowler D, Hofman P, Lino M, Makino Y, Moskala A, O'Donnell C, Sajantila A, Vallis J, Woodford N, Wozniak K. Use of Radiology in Disaster Victim Identification: Positional statement of the members of the Disaster Victim Identification working group of the International Society of Forensic Radiology and Imaging. 2013(1):218.
59. Brough AL, Morgan B, Rutty GN. The basics of disaster victim identification. J.Foren Radio Imaging. 2015;(3):29-37.
60. Clinical Imaging Board. CT Equipment, Operations, Capacity and Planning in the NHS; 2015.
61. Rutty G. Can cross sectional imaging as adjunct or alternative to the invasive autopsy be implemented within the NHS? Leicester, England: NHS Implementation Sub-group; Oct. 2012. Available on https://www.aaptuk.org/media/news/2012/10/26/can-crosssectional-imaging-as-an-adjunct-andor-alternative-to-the-invasive-autopsy-be-implemented-within-the-nhs
62. Pounder D, Jones M, Peschel H. How can we reduce the number of coroner autopsies? Lessons from Scotland and the Dundee initiative. J. Roy Soc Med. 2011;104:19-24.

63. Baglivo M, Winklhofer S, Hatch M, Ampanozi G, Thali J, Ruder D. The rise of forensic and post-mortem radiology: Analysis of the literature between the years 2000 and 2011. J. Forensic Radiol Imaging. 2013;1:3-9.
64. Keefer R. It's not so elementary. ACR Bulletin. 2009;64(8):19-21.
65. National Research Council. Strengthening Forensic Science in the United States: A Path Forward Washington, DC: The National Academies Press.2009. Available on https://doi.org/10.17226/12589.
66. Thali MJ, Yen K, Schweitz W, Vock P, Boesch C, Ozdoba C, Schroth G, Ith M. Virtopsy imaging horizon in forensic pathology: Virtual autopsy by postmortem multislice computed tomography (MSCT) and magnetic resonance imaging (MRI) - a feasibility study. J. Forensic Sci. 2003;(48):386-403. www.afr.org.uk/index/about-us. Accessed September 10,2019
67. Kekana R.M. Forensic Medicine and the role of Radiographer. Health Professional Council of South Africa. 2012; RCT Newsletter.
68. Vermeulen L. Development of a radiographic dental implant guide for forensic identification using current dental implants. Department of Medical Imaging and Therapeutic Sciences' faculty of health and wellness sciences. Masters Thesis Cape Peninsula University of Technology; 2018.
69. Lukhozi S.M. Clinical forensic medicine and human rights doctors as human right defenders. S.A. J. Bioethics and Law. 2009;2(2) 67-69.
70. International Criminal Police Organization, DISASTER Victim Identification Guide. Available from: https://www.interpol.int/en/How-we-work/Forensics/Disaster-Victim-Identification-DVI. Accessed 2019, Sep 10.
71. Obafunwa JO, Okoye MI, Nwana EJ. Recent mass disaster in West Africa: the urgent need for training forensic experts in Africa. In: Okoye MI, Nwana EJ, eds. Forensic investigation and management of mass disasters. Ch. 17. USA: Lawyers and Judges Publishing Company, Inc; 2007:317–25.
72. Beck JW. What is the future of imaging in forensic practice? Radiography. 2011; 17(3):212-217.
73. Rutty GN, Biggs JP, Brough A, Morgan B, Webster P, Heathcote A, Dolan J, Robinson C. Remote post-mortem radiology reporting in disaster victim identification: experience gained in the 2017 Grenfell Tower disaster. Int J Legal Med. 2020; 134(2): 637–643
74. Pinto S, Schub T. Creutzfeldt-Jakob disease. Glendale California: CINAHL Information systems; 2012.

75. Brodgon BG, Thali MJ, Viner M, Forensic radiology in historical perspectives. 2nd ed. Boca Raton: CRC Press; 2010:3-7.
76. Kadu S, Patel V. Forensic radiology in India: current trends. Indian J. Basic Appl Med Res.2012;1:148-52.
77. Viner, MD. The Use of Radiology in Mass Fatality Events, in Adams BJ. and Byrd JE. Commingled Human Remains; Methods in Recovery, Analysis and Identification, Oxford Academic Press. 2014;87-122.
78. Sica G, Guida F, Bocchini G, Iaselli F, Iadevito I, Scaglione M. Imaging of drug smuggling by body packing. *Semin Ultrasound CT MR*. 2015;36(1):39-47. doi:10.1053/j.sult.2014.10.003
79. Reginelli A, Russo A, Urriaro F, Maresca D, Martiniello C, D'Andrea A, Brunese L, Pinto A. Imaging of body packing: errors and medico-legal issues. Abdomen Imaging. 2015 Oct 1; 40(7):2127-2142.
80. Stark MM. Clinical forensic medicine: a physician's guide. Totowa,NJ:Springer Science, Business Media LLC;2011.
81. Jurel SK. The role of dentists in forensic investigations. J. Forensic ;2012:148.
82. Kahana T, Hiss J. Forensic radiology. *Br J Radiol*. 1999;72(854):129-133. doi:10.1259/bjr.72.854.10365061
83. Viner, M.D., & Robson, J.R. Post-Mortem Forensic Dental Radiography - a review of current techniques and future developments. J. Forensic Radiol Imaging; 2017;8*:22-37.*
84. Manigandan T, Sumathy C, Elumalai M, Sathasivasubramanian S, Kaannan A. Forensic radiology in dentistry. J. Pharm Bioall Sci. 2015;7(5):260-264.
85. AL Ekrish AA, Ekram M.A. Comparative study of the accuracy and reliability of multidetector computed tomography and cone beam computed tomography in the assessment of dental implant site dimensions. DentoMaxillofac Rad. 2011;40:67-75.
86. Wood RE. Forensic aspects of maxillofacial radiology. Forensic Sci Int. 2006;59(1):67-75.
87. Da Salvo R, Prado FB, Caputo IGC, Devito KL, Botelho Tdl, Daruge Junior ED. The forensic importance of frontal sinus radiographs. J. Foren Leg Med. 2009;16:18-23.
88. Mundorff AZ, Vidoli G, Melinek J. Anthropological and radiographic comparison of vertebrae for identification of decomposed human remains. J. Foren Sci. 2006;51:1002-4.

89. Simpson EK, James RA, Eitzen DA, Byard RW. Role of orthopaedic implants and bone morphology in the identification of human remains . J. Foren Sci. 2007;52(2):442-8.
90. European Asylum Support Office (EASO) Age assessment practice in Europe. Luxembourg Publications Office of the European Union; 2011. Available on https://www.easo.europa.eu/sites/default/files/easo-practical-guide-on-age-assesment-v3-2018.pdf. Accessed on 15 January 2019
91. Dvorak J, George J, Junge A, Hodler J. Age determination by magnetic resonance imaging of the wrist in adolescent male football players. Br. J. Sports Med. 2007;41:45-52.
92. Roche AJ, Fortin G, Labbé J, Brown **J**, Chadwick D. The work of Ambroise Tardieu: the first definitive description of child abuse. Child Abuse Negl. 2005;29:325-34.
93. US Department of Health & Human Services, 2017. Available on https://journals.sagepub.com/doi/10.1177/003335491613100208
94. Frederick J, Goddard C, Oxley J. What is the dark figure of child homicide and how can it be addressed in Australia? Int. J. Inj Cont Saf Promot. 2013;20(3):209-217.
95. U.S. Department of health and human. Child maltreatment, statistics report for the children's Bureau services. 2015. Available on https.//www.//www.acf.hhs.gov/sites/default/files/cb/cm2015/. Accessed 10 September 2019.
96. Kraft JK. Imaging of non-accidental injury. Orthop Trauma. 2011;25:109–18.
97. National children's alliance, National statistics on child abuse. Available on http//www.National children alliance.org/media-room/media-kit/national-statistics-childabuse. Accessed10 September 2019.
98. Berger RP, Panigrahy A, Gottschalk S, Sheetz M. Effective radiation dose in a skeletal survey performed for suspected child abuse. J Pediatr. 2016;171:310–12.
99. Powell-Doherty RD, Raynor NE, Goodenow DA, Jacobs DG, Stallion A. Examining the role of follow-up skeletal surveys in non-accidental trauma. Am.J.Surg. 2017;213:606-10.
100. Akmatov MK. Child abuse in 28 developing and transitional countries: results from multiple indicator cluster surveys. Int.J.Epider. 2011;40:219-227.
101. Nguyen A. Imaging of non-accidental injury; what is clinical best practice? J. Med. Rad Sci. 2018;65(2):123-30.

102. Murray CJ, Lopez A. The global burden of disease: A comprehensive assessment of mortality and disability from disease, injuries and risk factors in 1990, projected to 2020. Cambridge, MA: Havard University Press; 1996.
103. Olatunya OS, Isinkaye AO, Oluwadiya KS. Profile of non-accidental childhood injury at a tertiary hospital in South west Nigeria. J. Trop. Pediatr. 2015;61:174-81.
104. Anochie I, Graham-Douglas IB. Non-accidental injuries associated with convulsions in Port Harcourt, Nigeria Anil Aggrawal's Int J ForensMed Toxicol.2000. Accessed on May 2019. Available from http://anilag grawal.com/ij/vol_001_no_002/paper009.html; 2000
105 Hsia RY, Ozgediz D, Jayaraman S, Kyamanywa P, Mutto M, Kobusingye OC. Epidemiology of child injuries in Uganda: Challenges for health policy J Public Health Afr.2011; 2:15
106. Jain N. The role of diagnostic imaging in the evaluation of child abuse. B.C. Med. J. 2015;57:336-40.
107. Sharma PG, Rajderkar DA. Forensic radiology to the rescue: Prenatal imaging used to solve a case of a newborn with suspected non-accidental trauma. J. Forensic Radiol Imaging. 2018(12):72-75
108. Pinto A, Reginelli F, Pinto G, Sica M, Scaglione FH, Romano I. Brunese L. Radiological and practical aspects of body packing. Br.J. Radiol; 2014:26(87) 1036:20130500.
109. Dietal M, Syed AK. Intestinal obstruction by an unusual foreign body, Can. Med. Assoc. J.1973 Aug 4; 109(3):211
110. de Baker H.M, Soerdjbalie-Maikoe V, Kubat B, Maes A. de Baker B.S. Forensic imaging in legal medicine in the Nertherlands: Retrospective analysis of over 1700 cases in 15 years' experience. J. Forensic Radiol Imaging; 2016(6):1-7.
111. Yen K, Thali M.J, Aghayev E, Jackowski C, Schweitzer W, Boesch C. Strangulation signs: initial correlation of MRI, MSCT and forensic neck findings. J. Magn Reson Imaging. 2005(22):501.
112. Yen K, Vock P, Christe A, Scheurer E, Plattner T, Schon C. Clinical forensic radiology in strangulation victims: forensic expertise based on magnetic resonance imaging (MRI) findings, Int J. Legal Med. 2007(121):115.
113. Brinkmann B, Madea B. Handbook of Forensic Medicine. Springer Berlin. 2004(1).
114. Baker M, Hughes N. The provision of forensic radiography: A research survey report, University of Central England, Birmingham. Radiography. 1997;4(3):249-323

115. Walsh M, Reeves P. When disaster strikes; the role of the forensic radiographer. Radiography. 2004; 10(1):33-43.
116. Rigney D, Davis M. Radiographers and non-accidental injury in children: an Irish perspective. Radiography. 2004;10(1):7-13.
117. Davis M, Reeves P. The radiographer's role in child protection: Comparison of radiographers' perceptions by use of focus groups. Radiography. 2006;12(2):161-168.
118. Creswell JW, Creswell JD. Research design: Qualitative, quantitative, and mixed methods approaches. Los Angeles: Sage Publications; 2018.
119. Tracy SJ. Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. Qualitative Inquiry. 2010;16(10):837-51.
120. Litchman M. Qualitative research from in education. A user guide. 3rd ed. London: Sage Publications; 2013.
121. Yin RK. Qualitative research from start to finish .New York: The Guilford Press; 2011.
122. Kumar KR. Research in Methodology. A step by step guide for beginners. London:Sage Publications; 2011.
123. Lichtman M. Qualitative research for the social sciences: Sage Publications; 2013.
124. Denzin NK. Sociological methods: A sourcebook: Routledge; 2017.
125. Erlingson C, Brysiewicz P. A hands-on guide to doing content analysis. Afr J Emerg Med. 2017; 7(3):93-9.
126. Ormrod J.E. Practical research planning and design 9th ed. NewJersey: Prentice Hall; 2010.
127. Bless C, Higson-Smith C, Sithole SL. Fundamentals of social research methods. An African perspective. 5th edn. Cape Town: Juta; 2014.
128. De Vos AS, Strydom H, Fouche CB, Delport CSL. Research at grass roots for the social sciences and human service professions. 4th ed. Pretoria: Van Schaik; 2011.
129. Botma Y, Greeff M, Mulaudzi FM, Wright SCD. Research in health sciences. Pearson education South Africa; 2010. Available on https://www.loot.co.za/product/y-botma-research-in-health-sciences/lrwc-723-g000
130. Brink H, Van der Walt C, Van Rensburg G. Fundamentals of research methodology for health professionals. Cape Town: Juta; 2012.
131. Long BW, Frank ED, Ehrlich RA. Radiography essentials for limited practice e-book: Elsevier Health Sciences; 2016. Available on https://www.elsevier.com/books/radiography-essentials-for-limited-practice/long/978-1-4557-4203-5

132. Payne-Jones JJ, Stark MM. Clinical Forensic Medicine: History and Development: A Physician's Guide. 2nd ed. Totowa NJ: Springer; 2011.
133. Radiographers Registration Board of Nigeria. Code of professional conduct and ethics: Medical Imaging Society of Nigeria: Article 2. R.R.B.N; 2018.
134. Van Manen M. Researching lived experience: Human science for an action sensitive pedagogy. Oxfordshire. Routledge; 2016.
135. Stewart DW, Shamdasani PN. Focus groups: Theory and practice. 3rd ed. California CA. Sage publications; 2014
136. Krueger RA, Casey MA. Focus groups: A practical guide for applied research: 5th ed. Thousand Oaks, Calif. Sage publications; 2014.
137. Stevenson A, Waite M. Concise Oxford English Dictionary: Book & cd- room set; Oxford University Press; 2011.
138. Viesec I. A scheme for analyzing the results of focus groups .Int. J. Qual Methods. 2007:6(4):20-34.
139. Barbour RS. Analysing focus groups. The SAGE Handbook of Qualitative Data Analysis. 2014 Availableonhttps//dx.doi.org/10.4135/9781446282243
140. Braun V, Clark V. Using thematic analysis in psychology. Qual. Res. Psychol. 2006; 3(2):77
141. Clarke V, Braun V. Thematic Analysis. In: Michalos A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Dordrecht: Springer; 2014.
142. Clarke V, Braun V. Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. The Psychologist, 2013;26(2)120-23.
143. Bryman A. Social research methods. 4th ed. Oxford: Oxford University Press; 2012.
144. Pope C, Mays N, Popay J. Synthesing qualitative and quantitative health evidence: A guide to methods. Open University Press. McGraw-Hill Education; 2007.
145. Hiles DR. Narrative Inquiry: In Coghlan, D and Brydon-Miller, M. The Sage Encyclopaedia of Action Research. Three Oaks, Ill. Sage. 2014(2)550-553.
146. Adu, P. A Step-by-Step Guide to Qualitative Data Coding. London: Routledge;2019 https://doi.org/10.4324/9781351044516
147. Lincoln SL, Guba E.G. Naturalistic inquiry. London: Sage;1985.
148. Memarian R, Ahmadi F, Vaismoradi M. The leadership concept in Iranian nursing. Int. Nurs Rev. 2008:48-54
149. Burns N, Grove SK. The practice of nursing research: appraisal, synthesis, and generation of evidence. 6th ed. St.Louis. Elsevier Saunders; 2009.

150. Stringer E.T. Action research. 4th ed. Thousand Oaks CA. Sage; 2014.
151. Baskerville B, In Coghlan D, Brydon Miller C. Rigour, eds. The Sage Encyclopaedia of Action Research. London: Sage; 2014;690-92.
152. Malone J, Guleria R, Craven C, Horton P, Järvinen H, Mayo J, et al. Justification of diagnostic medical exposures: Some practical issues. Report of an international atomic energy agency consultation. Brit J Radiol. 2012;85(1013):523-38.
153. Morgan B, Adlam D, Robinson C, Pakkal M, Rutty GN. Adult post-mortem imaging in traumatic and cardiorespiratory death and its relation to clinical radiological imaging. Brit J Radiol. 2014;87:20130662.
154. Ehrlich R, Coakes D. Patient care in radiography: With an introduction to medical imaging, 8th ed. St. Louis,MO: Elsevier; 2013.
155. Sherer MAS, Visconti PJ, Ritenour ER, Haynes K. Radiation protection in medical radiography-e- book: Elsevier Health Sciences; 2017. Available on https://www.elsevier.com/books/radiation-protection-in-medical-radiography/statkiewicz-sherer/978-0-323-17220-2
156. McQuillen-Martensen K. Radiographic image analysis. 3rd ed. St. Louis, Mo: Saunders/Elsevier; 2011.
157. Denzin N, Lincoln Y, Guba EG. Paradigmatic controversies, contradictions, and emerging confluences, revisited. The Sage Handbook of Qualitative Research. Thousand Oaks: Sage; 2011:97-128.
158. Glaysher E. Vallis J. Reeves P. Post-traumatic stress disorder and the forensic radiographer. Radiography. 2016;22:212-215.
159. Health Department. Ehealth strategy, South Africa 2012-2017. S.A. Department of Health, Pretoria; 2012.

.

ANNEXURE A: Approval from University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.
- FWA 00002567, Approved dd 22 May 2002 and Expires 03/20/2022.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 03/14/2020.

3/09/2018

Approval Certificate
New Application

Ethics Reference No: 416/2018

Title: EXPLORING THE EXPERIENCES,ATTITUDES AND KNOWLEDGE OF RADIOGRAPHERS AND FORENSIC PATHOLOGISTS REGARDING FORENSIC RADIOGRAPHY SERVICES IN LAGOS STATE,NIGERIA

Dear Mr Kazeem Sangonuga

The **Amendment** as described in your documents specified in your cover letter dated 2/09/2018 received on 3/09/2018 was approved by the Faculty of Health Sciences Research Ethics Committee on its quorate meeting of 3/09/2018.

Please note the following about your ethics approval:
- Ethics Approval is valid for 1 year
- Please remember to use your protocol number (416/**2018**) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:
- The ethics approval is conditional on the receipt of **6 monthly written Progress Reports**, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

Dr R Sommers; MBChB; MMed (Int); MPharMed,PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

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

Research Ethics Committee
Room 4-60, Level 4, Tswelopele Building
University of Pretoria, Private Bag X323
Arcadia 0007, South Africa
Tel +27 (0)12 356 3084
Email deepeka.behari@up.ac.za
www.up.ac.za

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

ANNEXURE B: Request for permission to conduct the study at Lagos state

Permission to do Research, interview of radiographers and forensic pathologist at Lagos State University Teaching Hospital

To: Chief Executive Officer/Information Officer
Lagos State University Teaching Hospital.
Professor. DAVID ADEWOLE OLU

From: The Investigator
–
Kazeem Sangonuga

Re: Permission to do research at Lagos State University Teaching Hospital.
I am the principal researcher doing my masters in radiography diagnostics, Faculty of health sciences. University of Pretoria.

I am requesting permission to conduct a focus group interview for radiographers and forensic pathologists on the hospital grounds.

The request is lodged with you in terms of the requirements of the Promotion of Access to Information Act. No. 2 of 2000.

The title of the study is: The experience of radiographers and forensic pathologist in forensic radiography in Lagos-State, Nigeria.

The researcher intends to publish the findings of the study in a professional journal and/ or at professional meeting like symposia, congresses, or other meetings of such a nature.

The researcher intends to protect the personal identity of the participants by assigning each participant a random code number.

I undertake not to proceed with the study until we have received approval from the Faculty of Health Sciences Research Ethics Committee, University of Pretoria.

Yours sincerely

Signature of the Principle Investigator

Permission to do the research study at this hospital and to access the information as requested, is hereby approved.

Chief Executive Officer
Lagos State University Teaching Hospital
Dr Prof. D.A. Olu

Signature of the CEO 13/10/19

Chief Medical Director
Lagos State University Teaching Hospital, Ikeja
Hospital Official Stamp

ANNEXURE C: Information leaflet, consent form and question guide

PATIENT OR PARTICIPANT'S INFORMATION & INFORMED CONSENT DOCUMENT

(Investigator/Student to complete all sections in red text)

Researcher's name KAZEEM SOLA SANGONUGA

Student Number 17395811

Department of RADIOGRAPHY

University of Pretoria

Dear Participant **……**

(TITLE OF YOUR STUDY)

THE EXPERIENCES OF RADIOGRAPHERS AND FORENSIC PATHOLOGIST IN FORENSIC RADIOGRAPHY IN LAGOS STATE,NIGERIA.

I am a**[FIRST YEAR M.RAD]** student/s in the Department of **……RADIOGRAPHY……..,** University of Pretoria. You are invited to volunteer to participate in our research project on **STUDY TITLE**.THE EXPERIENCES OF RADIOGRAPHERS AND FORENSIC PATHOLOGISTS IN FORENSIC RADIOGRAPHY IN LAGOS STATE, NIGERIA.

This letter gives information to help you to decide if you want to take part in this study. Before you agree you should fully understand what is involved. If you do not understand the information or have any other questions, do not hesitate to ask us. You should not agree to take part unless you are completely happy about what we expect of you.

The purpose of the study is **…to develop a training programmed for radiographers on forensic radiography In Nigeria……..**

We would like you to participate in focus group discussion. This may take about **……1 hour……** The information given during the focus group discussion**.** It will be kept in a safe place to ensure confidentiality. Please do not mention your name in the audio recording. This will ensure confidentiality.

Refer to sensitive questions regarding eg. social and sexual habits. Should your focus group discussion have sensitive questions, warn participants that they need not answer questions that are of a sensitive nature to them.

The Research Ethics Committee of the University of Pretoria, Faculty of Health Sciences, telephone numbers 012 356 3084 / 012 356 3085 granted written approval for this study.

Your participation in this study is voluntary. You can refuse to participate or stop at any time without giving any reason. As you do not write your name on the questionnaire, you give us the information anonymously. Once you have given the questionnaire back

to us, you cannot recall your consent. We will not be able to trace your information. Therefore, you will also not be identified as a participant in any publication that comes from this study.

In the event of questions asked, which will cause emotional distress, then the researcher is able to refer you to a competent counselling.

Note: The implication of participating in focus group discussion is that informed consent has been obtained from you. Thus, any information derived from your form (which will be totally anonymous) may be used for e.g. publication, by the researchers.

We sincerely appreciate your help.

Yours truly,

(YOUR NAME) KAZEEM SOLA SANGONUGA

Dear Mr. / Mrs. ..... date of consent procedure ……../……../……..

1) INTRODUCTION

You are invited to volunteer for a research study. This information leaflet is to help you to decide if you would like to participate. Before you agree to take part in this study you should fully understand what is involved. If you have any questions, which are not fully explained in this leaflet, do not hesitate to ask the investigator. You should not agree to take part unless you are completely happy about all the procedures involved.

2) THE NATURE AND PURPOSE OF THIS STUDY

You are invited to take part in a research study. The aim of this study is to explore the experiences of radiographers and forensic pathologists in forensic radiography in Lagos state, Nigeria. By doing so we wish to develop a training programme for radiographers on forensic radiography. Forensic radiography can be useful in resolving crime cases.

3) EXPLANATION OF PROCEDURES TO BE FOLLOWED

The researcher will arrange a focus group discussion for 1hour. The main research question will be asked from the participants. What are the experiences of radiographers and forensic pathologists in forensic radiography? What you need to do is to tell the researcher about your experience in forensic radiography.

4) RISK AND DISCOMFORT INVOLVED.

There is no possible risk and discomfort because there will be a discussion between the researcher and the participants. 6-10 participants will be recruited in each group.

5) POSSIBLE BENEFITS OF THIS STUDY.

Although as a participant you may not benefit directly. The outcomes of the study will be used to develop a training programmed and forensic radiography can be used to resolve crime cases.

6) I understand that my participation in this study is voluntary.

7) I may at any time withdraw from this study.

8) HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This Protocol was submitted to the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, telephone numbers 012 356 3084 / 012 356 3085 and written approval has been granted by that committee. The study has been structured in accordance with the Declaration of Helsinki (last update: October 2013), which deals with the recommendations guiding doctors in biomedical research involving human/subjects. A copy of the Declaration may be obtained from the investigator should you wish to review it.

9) INFORMATION If I have any questions concerning this study, I should contact:

Dr. Mable Kekana…….. tel : +27123563114……..or cell: ……

10) CONFIDENTIALITY

All information obtained whilst in this study will be regarded as confidential. Results will be published or presented in such a fashion that participants remain unidentifiable.

11) CONSENT TO PARTICIPATE IN THIS STUDY.

I have read or had read to me in a language that I understand the above information before signing this consent form. The content and meaning of this information have been explained to me. I have been given an opportunity to ask questions and am satisfied that they have been answered satisfactorily. I hereby volunteer to take part in this study.

I have received a signed copy of this informed consent agreement.

.....	.....
Participant name	Date
.....	.....
Participant signature	Date
.....Kazeem Sangonuga.....	
.....18/10/2017.....	
Investigator's name	Date
.....K.S.....	.....18/10/2017.....
Investigator's signature	Date
.....	.....
Witness name and signature	Date

ANNEXURE D: Interview guide for Radiographers

1. What are your experiences, attitudes and knowledge about performing forensic radiography examinations?
2. When you hear the word “forensic radiography’’ what is the first thing that comes to your mind?
3. What do you consider to be the responsibilities that should be included in the role of radiographers as members of the forensic team?
4. How do you feel about performing forensic radiography examinations on dead or living individuals?
5. Describe the teaching and learning background that you have in forensic radiography.
6. How do you view your role with regards to performing forensic radiography examinations?
7. What are your recommendation as a radiographer towards forensic radiography education in Lagos State, Nigeria?

ANNEXURE E: Interview guide for Forensic Pathologists

1. What are your experiences, attitudes and knowledge about forensic radiography examinations?
2. When you hear the word “forensic radiography’’ what is the first thing that comes to your mind?
3. What do you consider to be the responsibilities that should be included in the role of radiographers as members of the forensic team?
4. How do you feel about the quality of the forensic radiography examinations performed on dead or living individuals?
5. What are your recommendation as a forensic pathologist towards forensic radiography education in Lagos State, Nigeria?

ANNEXURE F: Declaration of storage of data

I, Kazeem Sola Sangonuga of the following study titled: exploring the experience,attitude and knowledge of radiographers and forensic pathologists with regard to forensic radiography services in Lagos State will be storing all the research data and/or documents referring to the above-mentioned trial/study at the following address:

Department of Radiography HW Snyman Building

Level 4 – Radiography Storeroom

Gezina Pretoria 0186

I understand that the storage for the abovementioned data and/or documents must be maintained for a minimum of 15 years from the commencement of this trial/study.

START DATE OF TRIAL/STUDY:____August 2017_____

END DATE OF TRIAL/STUDY:_____April, 2020 UNTIL WHICH YEAR WILL DATA WILL BE STORED: _ 2033____

Name: Kazeem Sola Sangonuga_____

Signature ____K.S___

Date__04/04/2020_____

ANNEXURE G: Codes and Categories

Code: 1.1 Perceptions of forensic radiography

Quotation: 37 - PD: Focus group 1.docx - [10: 10]

Participant 1: Imaging of the dead person for autopsy cases.

Quotation: 38 - PD: Focus group 1.docx - [11: 11]

Participant 2: Application in the management of child abuse also comes to mind.

Quotation: 39 - PD: Focus group 1.docx - [12: 12]

Participant 3: Specialized techniques deployed for forensic investigations but we talk more of the post-mortem purposes. We can also use it for child abuse.

Quotation: 40 - PD: Focus group 1.docx - [13: 13]

Participant 4: I think of disaster victim identification and also to investigate gunshots.

Quotation: 41 - PD: Focus group 1.docx - [14: 14]

Participant 5: Application of radiography to forensics. It is used in cases of child abuse, sports, customs, immigration, even in physical abuse, domestic violence.

Quotation: 48 - PD: Focus group 1.docx - [6: 6]

Participant 3: We should not forget to mention the aspect of gunshot cases. Forensic radiography was used in disaster victim identification and it was a good success. The radiographs produced were of good quality and the radiologists reported them.

Quotation: 49 - PD: Focus group 1.docx - [5: 5]

Participant 2: Here, the practice was unpopular until 2012 when the Dana plane crash happened. It was the first time here we have to use x-rays to identify bodies.

Quotation: 43 - PD: Focus group 2.docx - [13: 13]

PARTICIPANT 1: Research on dead bodies, also for criminal cases.

Quotation: 44 - PD: Focus group 2.docx - [14: 14]

PARTICIPANT 2: To investigate the cause of death.

Quotation: 45 - PD: Focus group 2.docx - [15: 15]

PARTICIPANT 3: Here in Nigeria, it is about dead bodies.

Quotation: 46 - PD: Focus group 2.docx - [16: 16]

PARTICIPANT 4: Autopsy.

Quotation: 47 - PD: Focus group 2.docx - [17: 17]

PARTICIPANT 5: Death

Quotation: 48 - PD: Focus group 2.docx - [18: 18]

PARTICIPANT6: Autopsy

Quotation: 49 - PD: Focus group 2.docx - [19: 19]

PARTICIPANT 7: Death

Quotation: 50 - PD: Focus group 2.docx - [20: 20]

PARTICIPANT 8: for autopsy cases question to law.

Quotation: 25 - PD: Focus group 3.docx - [10: 10]

PARTICIPANT 1: Radiography of the dead.

Quotation: 26 - PD: Focus group 3.docx - [11: 11]

PARTICIPANT 2: For criminal investigation.

Quotation: 27 - PD: Focus group 3.docx - [12: 12]

PARTICIPANT 3: Investigation to know the cause and manner of death.

Quotation: 28 - PD: Focus group 3.docx - [13: 13]

PARTICIPANT 4: Research on the dead or living for legal purposes.

Quotation: 31 - PD: Focus group 3.docx - [26: 26]

PARTICIPANT 5: We attend to many living patients every day we don't know they are forensic in nature like abuse.

Quotation: 36 - PD: Focus group 3.docx - [36: 36]

PARTICIPANT 3: Earlier in my practice, I took the images of drug pushers but then I did not know it was forensics.

Code: 1.2 Experiences of forensic radiography

Quotation: 32 - PD: Focus group 1.docx - [4: 4]

Participant 1: No personal experience

Quotation: 42 - PD: Focus group 1.docx - [15: 16]

Interviewer- Prof Sir, as forensic pathologist have you stand in the court of law to present forensic cases of a living patient as a result of child abuse and domestic

violence.

Participant 5: No because I haven't been involved in it but if something like that was brought to me. It would not be a problem.

Quotation: 63 - PD: Focus group 2.docx - [8: 8]

PARTICIPANT 5: I have gathered quite a lot of experience in forensics. I can say that forensics is the best aspect of radiography for me despite that it can be really stressful and time confusing.

Quotation: 20 - PD: Focus group 3.docx - [4: 4]

PARTICIPANT 1: I once had an experience here that involved army officer who was shot by armed robbers but later died. I have also image someone who was stabbed and the knife was left in the patient body.

Quotation: 21 - PD: Focus group 3.docx - [5: 5]

PARTICIPANT 2: I have also had an experience that involved a dead person. They were night crawlers and were found dead and no one knew the cause of death and we had to do some sort of skeletal survey. I have also had to deal with a battered child and a skeletal survey was done too. I was afraid at first but after getting it. I was okay.

Quotation: 22 - PD: Focus group 3.docx - [6: 6]

PARTICIPANT 3: Here in LUTH a female dead body that was strangulate as a result of domestic violence and wanted to ascertain if it was murder or suicide. A full body CT scan was done but we did not get the final details of the investigation.

Quotation: 23 - PD: Focus group 3.docx - [7: 7]

PARTICIPANT 4: A gunshot case, that was brought in dead and we had to do total body survey to find the bullet through we could not find it. If we had tried other modalities we

might have had better luck.

Quotation: 24 - PD: Focus group 3.docx - [8: 8]

PARTICIPANT 5: I once did CT for a living patient that I saw cocaine in the patient. I don't it was forensic.

Code: 1.3 Negative experiences of forensic radiography

Quotation: 57 - PD: Focus group 2.docx - [4: 4]

PARTICIPANT 1: It is normal radiography just that we are dealing with dead bodies. Sometimes the bodies are macerated or smelling which requires modification in techniques.

Quotation: 58 - PD: Focus group 2.docx - [5: 5]

PARTICIPANT 2: I can also easily make reference to the DANA crash even after 2 weeks they were still bringing in bodies and most times these bodies were in pieces and decomposing. It was a really disturbing period. The work was really tedious that we had to leave late about 9-10pm and the positioning was difficult since the body could not take instructions.

Quotation: 59 - PD: Focus group 2.docx - [10: 10]

PARTICIPANT 7: It is not something I am really happy doing, dealing with dead bodies is not such a nice thing which even makes it worse when it comes to positioning. I am also always concerned about infections if all these things are taken care of I might be more interested.

Quotation: 60 - PD: Focus group 2.docx - [6: 6]

PARTICIPANT 3: My major experience was here in Lagos State University Teaching Hospital. I also did one on a dead patient in my former Centre. The body was still fresh

and they were trying to ascertain the cause of death. Sometime last year, I also attended to a patient that was set ablaze, they were also trying to confirm the identity. Some of the body parts even fall apart and there was not enough protection against infection to me it wasn't interesting just tedious, positioning was also difficult even after immobilization. This also led to poor radiographs.

Quotation: 61 - PD: Focus group 2.docx - [7: 7]

PARTICIPANT 4: In 2013 during my internship, there was also a plane crash and the bodies were brought in. It was both emotionally and physically stressful for me as it was my first time. Positioning also was not easy and the image processing was stressful too.

Quotation: 66 - PD: Focus group 2.docx - [9: 9]

PARTICIPANT 6: I have also had problems during my experiences with forensics. The positioning was stressful and the machine also gave us problems. I am not really interested in forensics.

Quotation: 67 - PD: Focus group 2.docx - [33: 33]

PARTICIPANT 1: It is brain tasking can be emotional sometimes.

Code: 1.4 Lack of dedicated forensic radiographic infrastructure and equipment

Quotation: 8 - PD: Focus group 1.docx - [7: 7]

Participant 4: Then the dark room equipment got bad and still hasn't been repaired. After overcoming resistance from the radiographers, there is no funding from the government.

Quotation: 31 - PD: Focus group 1.docx - [7: 7]

Participant 4: I agree with the some of the things said earlier. At the beginning in year 2005-2006, there was a negative attitude from radiology department which i will blame

on ignorance. The negative attitude was not expected because they primarily deal with live patients and having a dead body on the same table with living patients can be a problem. Sometimes, we had to wait until evening when the patient flow was less to take the bodies to radiology.

Quotation: 4 - PD: Focus group 2.docx - [5: 5]

Participant 2: The pathologists kept on pressuring us to be fast without considering the constraints and sometimes these bodies were brought in during the day affecting the live patients. We had to make arrangements for the bodies to be brought in during call hours.

Quotation: 42 - PD: Focus group 2.docx - [11: 11]

PARTICIPANT 8: To me in Nigeria we are not ready for forensics. The place is smelly which should not be and adequate steps are not taken to prevent infection.

Quotation: 8 - PD: Focus group 3.docx - [23: 23]

PARTICIPANT 2: They should have their own equipment's because bringing in bodies can cause the live patients to become apprehensive about their own examinations.

Quotation: 9 - PD: Focus group 3.docx - [24: 24]

PARTICIPANT 3: I feel the same way.

Code: 1.5 Poor quality of forensic radiographic images

Quotation: 21 - PD: Focus group 1.docx - [24: 24]

Participant 1: I am used to the analogue images but from what I have seen the quality of the images are not as good as that of the living ones. I think might be due to the degree of penetration. These images do not last for a long time.

Quotation: 22 - PD: Focus group 1.docx - [25: 25]

Participant 2: I agree with participant one . Analog is what we used here for autopsy.I have seen the digital images for living patient they are very good images. I think we need digital images for autopsy cases.

Quotation: 23 - PD: Focus group 1.docx - [26: 26]

Participant 3: They said it all.

Quotation: 24 - PD: Focus group 1.docx - [27: 27]

Participant 4: Quality varies and it is a function of technique It would be nice to have something better that can be stored in our archives for a longer period.

Quotation: 25 - PD: Focus group 1.docx - [28: 28]

Participant 5: In relation to being able to produce these images in 5 years,one thing that we have able to do is that we scan them, save into the system and produce CDs as our final storage copies which enables us to store them for a long period.

Quotation: 36 - PD: Focus group 2.docx - [11: 11]

Participant 8: I also believe that image processing should be upgraded to digital this will make the work faster, reduce physical stress and better images will be produced.

Quotation: 37 - PD: Focus group 2.docx - [8: 8]

Participant 5: My major challenge especially here in LASUTH is the machine. During the Otedola building collapse, we were not able to get optimum images because the equipment was working in the best condition.

Code: 1.6 Delay in getting forensic results and reports

Quotation: 5 - PD: Focus group 1.docx - [6: 6]

Participant 3: There are also constraints apart from their reluctance to come, there was also delay in getting the reports to us. There used to be a processing room here but when it got bad, there has been delay in moving the films around and getting faster results.

Quotation: 2 - PD: Focus group 2.docx - [4: 4]

Participant 1: There also the constraint of moving the cassette from the morgue to the department before they can be processed which leads to delay during Dana air crash.

Code: 4.1 Responsible for quality forensic radiographic images

Quotation: 45 - PD: Focus group 1.docx - [20: 20]

Participant 3: Their role is to take the film with the aim of getting the best results so that can complement our autopsy findings.

Quotation: 47 - PD: Focus group 1.docx - [22: 22]

Participant 5: Their role is to produce radiograph; shoot the films produce good quality radiographs. They do not work in insolation but with the radiologists to produce the best results.

Quotation: 55 - PD: Focus group 1.docx - [19: 19]

Participant 2: To work together with radiologists to get better images.

Quotation: 56 - PD: Focus group 2.docx - [28: 28]

PARTICIPANT 6: Radiographers should decide the views to take before autopsy.

Code: 4.2 Involvement in the total forensic investigation

Quotation: 43 - PD: Focus group 1.docx - [18: 18]

Participant 1: To assist the radiologists in dealing with matters as it relates to forensics

Quotation: 20 - PD: Focus group 2.docx - [23: 23]

PARTICIPANT 1: Though we have not been invited to go to court with any one, I think that our roles could be more extensive and not just about taking images. We can advise the team on additional views and positioning

Quotation: 21 - PD: Focus group 2.docx - [24: 24]

PARTICIPANT 2: Radiographers should not just limited to taking the images. They might be needed to tell the story behind the image since they are the ones that saw the body. They should be able to go to court.

Quotation: 24 - PD: Focus group 2.docx - [27: 27]

PARTICIPANT 5: Radiographers should be able to go to court with the team.

Quotation: 34 - PD: Focus group 3.docx - [34: 34]

PARTICIPANT 1: We should have the whole experience from start to finish so as to improve experience aid in subsequent cases.

Quotation: 35 - PD: Focus group 3.docx - [35: 35]

PARTICIPANT 2: The radiographer should be given full report of the case even after taking images

Code: 4.3 Function as a full member of the forensic team

Quotation: 46 - PD: Focus group 1.docx - [21: 21]

Participant 4: Radiographers do not work alone but they work with forensic pathologists

and radiologists as a team and follow the protocol developed by the virtopsy team.

Quotation: 54 - PD: Focus group 2.docx - [26: 26]

PARTICIPANT 4: Radiographers should be involved in the team.

Quotation: 55 - PD: Focus group 2.docx - [25: 25]

PARTICIPANT 3: Radiographers should not act as subordinate. Radiographers should be able to advise the team.

Quotation: 2 - PD: Focus group 3.docx - [17: 17]

PARTICIPANT 2: We should be part of the team and this can also help to improve our current knowledge.

Quotation: 3 - PD: Focus group 3.docx - [16: 16]

PARTICIPANT 1: Radiographers should be part of the team and also know the outcome.

Quotation: 5 - PD: Focus group 3.docx - [19: 19]

PARTICIPANT 4: We should be part of the team till the end, since we are one that took the initial images.

Quotation: 6 - PD: Focus group 3.docx - [20: 20]

PARTICIPANT 5: Radiographers should not be subordinate in team.

Code: 5.1 Ensure adequate forensic radiographic equipment and infra-structure

Quotation: 29 - PD: Focus group 1.docx - [33: 33]

Participant 4: Improving forensic radiography is tied to improving forensic study in the state and country which entail every pathology department having their own portable x-

ray devices which makes government funding very important.

Quotation: 50 - PD: Focus group 1.docx - [34: 34]

Participant 5: If we are to have a large scale forensic department

Quotation: 64 - PD: Focus group 2.docx - [8: 8]

Participant 5: I would also appreciate a dedicated unit for forensics so as to avoid cross contamination

Quotation: 30 - PD: Focus group 3.docx - [22: 22]

PARTICIPANT 1: The morgue should have their own mobile machine and all other accessories including cassettes, gowns, gloves and face masks.

Quotation: 32 - PD: Focus group 3.docx - [25: 25]

PARTICIPANT 4: The morgue should have their equipment to be operated by radiographers.

Code: 5.2 Training in forensic radiography (introduction on undergraduate level and postgraduate speciality training)

Quotation: 27 - PD: Focus group 1.docx - [31: 31]

Participant 2: Since this is highly skilled specialty, I think it should be studied at undergraduate level but there can be an introductory course on it to steer the interest.

Quotation: 52 - PD: Focus group 1.docx - [30: 30]

Participant 1: Government should invest in training all cadres of staffs including radiographers who want to take interest in forensic radiography. A specialty should be created for radiographers who are interested in the field. There should be awareness about forensic radiography. A postgraduate level course should also be introduced for

interested radiographers.

Quotation: 53 - PD: Focus group 1.docx - [32: 32]

Participant 3: I am not sure how robust postgraduate course in radiography in Nigeria. I think forensic radiography should be included. During the internship year after graduation should rotate forensic pathology department.

Quotation: 54 - PD: Focus group 1.docx - [34: 34]

Participant 5: Forensic radiography should be thought as postgraduate level.

Quotation: 14 - PD: Focus group 2.docx - [52: 52]

PARTICIPANT 1: It should be included in undergraduate curriculum as an introduction to forensic radiography.

Quotation: 16 - PD: Focus group 2.docx - [54: 54]

PARTICIPANT 3: Basics should be introduced during undergraduate years.

Quotation: 17 - PD: Focus group 2.docx - [55: 55]

PARTICIPANT 4: Start introductory class in undergraduate and post graduate course should be introduce.

Quotation: 18 - PD: Focus group 2.docx - [57: 57]

PARTICIPANT 5: Students can be posted to pathology department to learn basic skills during their clinical posting.

Quotation: 52 - PD: Focus group 2.docx - [53: 53]

PARTICIPANT 2: It should be a post graduate course.

Quotation: 53 - PD: Focus group 2.docx - [58: 58]

PARTICIPANT 6: Forensic radiography should be a specialty as post graduate level as it done in developed world.

Quotation: 65 - PD: Focus group 2.docx - [8: 8]

Participant 5: with more training I can do better.

Quotation: 68 - PD: Focus group 2.docx - [35: 35]

PARTICIPANT 3: Training is very important

Quotation: 17 - PD: Focus group 3.docx - [40: 40]

PARTICIPANT 1: There should be a certification course on forensic radiography and the scope should be widened at undergraduate level to improve basic knowledge.

Quotation: 18 - PD: Focus group 3.docx - [43: 43]

PARTICIPANT 4: It should be added to the curriculum so that we will be able to meet up with the demands.

Quotation: 19 - PD: Focus group 3.docx - [44: 44]

PARTICIPANT 5: The training program should be elaborate during undergraduate to steer people interest to forensic radiography.

Quotation: 29 - PD: Focus group 3.docx - [38: 38]

PARTICIPANT 5: We should have training first before any role.

Quotation: 33 - PD: Focus group 3.docx - [18: 18]

PARTICIPANT 3: Regularly doing this examinations will also help us to know what to do

and serve the next body better

Code: 5.3 Ensure support in cases of suspected abuse

Quotation: 69 - PD: Focus group 2.docx - [37: 37]

PARTICIPANT 5: There should be new laws put in concerning attending to patients that come in with suspected abuse trauma.

Quotation: 70 - PD: Focus group 2.docx - [38: 38]

PARTICIPANT 6: There should be a department to report to when you see abuse patient.

Quotation: 71 - PD: Focus group 2.docx - [36: 36]

PARTICIPANT 4: There should be other department that should work in hand with the radiology department for when cases like this are brought in.

Quotation: 38 - PD: Focus group 3.docx - [41: 41]

PARTICIPANT 2: More attention should be paid to child abuse cases so that they can be reported to the necessary authorities. Even cases of domestic violence.

Code: Inadequate knowledge and skills of forensic radiography

Quotation: 36 - PD: Focus group 1.docx - [7: 7]

With regards to expertise, personally I noticed that the radiographers are not well skilled with post-mortem imaging because they had to make repeat many views before we can get a good radiograph.

Quotation: 26 - PD: Focus group 2.docx - [40: 40]

PARTICIPANT 1: I had to learn on the job. No previous experience in school. I learnt

from my bosses.

Quotation: 27 - PD: Focus group 2.docx - [41: 41]

PARTICIPANT 2: It is something I just stumbled on. No training from school.

Quotation: 28 - PD: Focus group 2.docx - [42: 42]

PARTICIPANT 3: Since we are expected to be jack of all trades. I have to learn about forensic on my own.

Quotation: 29 - PD: Focus group 2.docx - [43: 43]

PARTICIPANT 4: No teaching and learning background in forensic radiography.

Quotation: 30 - PD: Focus group 2.docx - [44: 44]

PARTICIPANT 5: It is not in our curriculum as radiographers in Nigeria.

Quotation: 31 - PD: Focus group 2.docx - [45: 45]

PARTICIPANT 6: No teaching program in forensic radiography.

Quotation: 32 - PD: Focus group 2.docx - [46: 46]

PARTICIPANT 7: No learning program in forensics

Quotation: 33 - PD: Focus group 2.docx - [47: 47]

PARTICIPANT 8: No teaching and learning background in forensic radiography.

Quotation: 72 - PD: Focus group 2.docx - [7: 7]

Participant 4: The pathologists were friendly to me but not all the radiographs were good. I can attribute this to lack of training in forensic radiography.

Quotation: 12 - PD: Focus group 3.docx - [28: 28]

PARTICIPANT 1: I had undergraduate experience in school we were introduced to it in class and I had first practical experience during my SIWES.

Quotation: 13 - PD: Focus group 3.docx - [29: 29]

PARTICIPANT 2: It was introduced to me during undergraduate years too but not extensively and I did not have any clinical experience in school.

Quotation: 14 - PD: Focus group 3.docx - [30: 30]

PARTICIPANT 3: We were taught briefly but not expanded as other topics in radiography.

Quotation: 15 - PD: Focus group 3.docx - [31: 31]

PARTICIPANT 4: It was just a topic under a course not a full course on its own.

Quotation: 16 - PD: Focus group 3.docx - [32: 32]

PARTICIPANT 5: No teaching and learning program in forensic. It is not part of our curriculum.

Quotation: 37 - PD: Focus group 3.docx - [37: 37]

PARTICIPANT 4: I agree we did not have enough training concerning forensic radiography.

Code: Negative attitudes towards forensic radiography

Quotation: 9 - PD: Focus group 1.docx - [8: 8]

Participant 5; Radiographers and some of the radiologist need to show more interest on forensic especially on the part of autopsy. I have seen a few of them showing interest

and some of them vehemently oppose and come grudgingly.

Quotation: 33 - PD: Focus group 1.docx - [4: 4]

Participant 1: but there has been delays between the time of the investigation and reporting time. I think the long interface might be as a result of their reluctance to perform these investigations.

Quotation: 34 - PD: Focus group 1.docx - [5: 5]

Participant 2: Radiographers are always unwilling to come and perform x-rays on dead bodies.

Claudia Boffard

Academic Documents Language Editor

14 Shannon, 6th Road, Hyde Park 2196, Johannesburg GP

email: boffard@mweb.co.za phone: (27) 011 325 4950 cell: 076 523 0617

11 May 2020

Letter of Confirmation

This confirms that I have language edited the dissertation (excluding all annexures): *Exploring the experiences, attitudes and knowledge of radiographers and forensic pathologists regarding radiography services in Lagos State, Nigeria* by Kazeem Sola Sangonuga.

All errors identified were corrected and marked with the 'track changes' function.

The document was edited in accordance with the latest conventions of English style and expression.

Claudia Boffard