

A QUALITY FRAMEWORK FOR DIAGNOSTIC IMAGING SERVICES IN REGIONAL HOSPITALS IN THE ETHEKWINI DISTRICT OF KWAZULU-NATAL, SOUTH AFRICA

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Declaration

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is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources).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

Signature of student

20 June 2021

Date

Approved for final submission

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Abstract

Background

Generally, diagnostic imaging services in Africa are challenged by many factors including lack of equipment and personnel, quality assurance and quality control measures, quality management and monitoring and evaluation frameworks. These challenges are further compounded by a lack of understanding of the factors responsible for poor imaging service delivery and the mitigation strategies. Furthermore, there is paucity of context specific research on diagnostic imaging service delivery in African countries including South Africa. A practice framework was deemed necessary to guide quality of services in diagnostic imaging services in regional hospitals within the eThekweni district of KwaZulu-Natal.

Aim

The aim of this study was to explore the factors affecting quality in diagnostic imaging departments of the regional hospitals in the eThekweni District of KwaZulu-Natal in order to develop a framework that can be used to improve quality.

Method

A convergent parallel mixed methods design was employed to explore factors affecting quality in medical imaging departments in regional hospitals in the eThekweni District of KwaZulu-Natal in South Africa. In addition, a stratified random sampling strategy was used for quantitative data collection whilst a purposive sampling strategy was used for the qualitative strand. The quantitative strand of the study used a questionnaire administered to patients to measure their levels of satisfaction with service delivery rendered by the diagnostic imaging departments. Data in the quantitative strand were analysed using Version 26.0 of the SPSS and tests such one sample t-test, univariate analysis, Analysis of Variance (ANOVA), Levene's Test for Equality of Variances, Spearman's rho and independent sample t-tests were used. Furthermore, the quantitative strand consisted of an image reject

analysis to investigate rates at which images were rejected and reasons for rejection.

The qualitative strand involved in-depth one-on-one interviews with doctors, radiographers, Radiography Managers and hospital wide Quality Assurance Managers. Questions regarding quality of service delivery, possible areas and strategies to improve quality were posed to participants. Responses were recorded through notes made by the primary researcher together with voice recordings. Content analysis was used to analyse qualitative data.

Findings

The construct that emerged from analysis of results from the patient satisfaction survey were cleanliness, staff, comfort, communication and booking times. There was significant agreement that all the aspects investigated were acceptable to the patients ($M > 3.5$, $SD > 7$). However, although patients were satisfied with comfort in the imaging departments in general, they were dissatisfied with the comfort of the waiting area. Reject rate analysis was conducted in three regional hospitals and the reject rates were different for each hospital (Hospital A = 12.67%, Hospital B = 10.67% and Hospital D = 4%). The average reject rate for all the hospitals was higher than the WHO benchmark of 10%.

Twenty eight participants including nine doctors, 13 radiographers, three QA Managers and three Radiography Managers were interviewed across the four regional hospitals during the qualitative strand. Four themes emerged following analysis of qualitative data and these included definition of quality of imaging services by the participants, inadequacy of clinical provisions, leadership and management of medical imaging departments as well as facilities and resources. Issues expressed by the participants regarding inadequacy of clinical provisions included patient referral protocols, communication, image quality and radiology reports. Furthermore, regarding leadership and management participants expressed opinions on roles and responsibilities, accountability, monitoring of

working hours and National Core Standards. Lastly, facilities resources included issues such as inadequacy of imaging equipment, inadequacy of staffing, and in-service training.

Conclusion

The findings reported in the current thesis and the resulting framework are highly relevant to policy and practice particularly in the eThekweni District. The involvement of patients and healthcare professionals in identifying challenges and solutions is a major strength of the current research. The current study has also uncovered the deficiencies in diagnostic imaging services in the eThekweni district around radiographers' knowledge of the National Core Standards. Finally, if implemented, the framework developed can be used to enhance equipment testing and maintenance policies and improve staff and patient satisfaction as well as staff development. These should increase quality in diagnostic imaging services.

Key words: Film/Image reject analysis, patient satisfaction, quality assurance, service delivery, Quality Management.

Dedication

This work is dedicated to my loving and caring mother, Nonkumbana Nofanele Jane Gam for her hard work and dedication in ensuring that although she was not fortunate enough to acquire formal education, her children would receive the best of it. She sacrificed many aspects of her life to make sure that all her children would become things she would not even dream to become. Her love, kindness, generosity, resilience and endurance will forever reign in my life. I am very confident that she would have been very proud to see me attaining such a glorious achievement. May her soul rest in eternal peace and may my actions resemble and honour her total self all the time. Enkosi maDlamini, Sibakhulu, Ndlovu zidlekhaya ngenxa yokuswela umalusi.

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Glossary of terms

Computed Radiography: A system of recording a radiographic image that uses an imaging plate coated with photostimulable phosphors to capture x-rays as they traverse through the patient (Schaefer-Prokop, De Boo and Uffmann 2009: 195).

Customers: In the current study, customers relate to patients undergoing imaging examinations and doctors referring patients for such examinations.

Customer satisfaction: “The extent to which the patients feel that their needs and expectations are being met by the service provider” (Qadri *et al* 2012: 1530).

Digital Radiography: This is a numeric representation of the x-ray intensities transmitted through the patient (Bontrager and Lampignano 2014: 47). Digital Radiography images are in digital form and are capable of being displayed on a computer monitor (Carlton and Adler 2013: 324).

Image Reject Analysis: A process in which one carefully determines the number of images rejected against the total number of images used during a particular period (Zewdeneh, Teferi, and Admassie 2008: 64). The process can be used to determine the reasons for rejecting images with the purpose of providing necessary interventions.

Medical Imaging Department: Medical Imaging Departments use a range of imaging modalities and procedures to obtain images of the human body so that diagnoses and subsequent treatment can be obtained (WHO 1999: 1).

National Core Standards: A set of standards developed by the Office of Standards Compliance from which quality of care is benchmarked (South Africa, Department of Health 2011: 8).

Patient satisfaction survey: A quality improvement approach used to gather the perceptions of patients about their level of satisfaction with service delivery (Joshi 2009: 370 and Zaid, Sillabutra and Keiwkarnka 2013: 342).

Quality assurance: Planned systematic actions intended to ensure confidence that a facility or system will provide safe and satisfactory services to customers (Bushong 2013: 612).

Quality control: A component of quality assurance that controls and verifies performance of equipment (Bushong 2013: 612).

Quality: Quality means absence of defects in a particular product or procedure (Bushong 2013: 612). In the current study quality refers to actions undertaken by medical imaging departments to improve service delivery to customers. This includes systems in place to ensure satisfaction of customers.

Quality management: The overall umbrella including all quality concepts such as quality assurance and quality control. It also encompasses all activities used by organisations to direct, control and coordinate quality (International Standards Organisation 2015: 8).

Rejected Image: An image that is deemed to provide no value to patient diagnosis as reviewed by the radiographer after taking it (Foos *et al.* 2009: 96). The radiographer should then provide the reason for rejecting the image.

List of acronyms

Acronym	Full word
AEC	Automatic Exposure Control
CHC	Community Health Care
CR	Computed Radiography
CT	Computed Tomography
DAP	Diagnostic Assessment Programmes
DHET	Department of Higher Education and Training
DQAC	Departmental Quality Assurance Committee
DR	Digital Radiography
DUT	Durban University of Technology
HIV	Human immunodeficiency virus
HPSCA	Health Professions Council of South Africa
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
IREC	Institutional Research Ethics Committee
ISO	International Standards Organisation
KZN	KwaZulu-Natal
MDG	Millennium Development Goals
MRI	Magnetic Resonance Imaging
NCS	National Core Standards
NDP	National Development Plan
NHI	National Health Insurance
OHSC	Office of Health Standards Compliance
PACS	Picture Archiving and Communication System
PHC	Primary Health Care
QA	Quality assurance
QC	Quality control

QIP	Quality Improvement Project
QWL	Quality of work life
RM	Radiography Manager
SAHPRA	South African Health Products Regulatory Authority
SARA	Service Availability and Readiness Assessment
SPSS	Statistical Package for the Social Sciences
TQM	Total Quality Management
UHC	Universal Health Coverage
UK	United Kingdom
UN	United Nations
USA	United States of America
WHO	World Health Organization

CHAPTER 1: OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND TO THE STUDY

Medical Imaging departments in the eThekweni district are faced with poor quality of services. Major challenges faced by the Medical Imaging departments include high stress levels; non-compliance with rendering of Quality Assurance (QA) and Quality Control (QC) programs, high image rejection rates; poor communication, lack of funding and long waiting queues (Gam, Naidoo and Puckree 2015; Rauf, Blitz, Geyser and Rauf 2008: 46e). In addition, some of the hospitals within the eThekweni district are faced with staff shortages and non-functioning of imaging equipment. Furthermore, compliance with the National Core Standards (NCS) has become a major challenge and it is not clear if the radiographers understand these standards. On the other hand, there is no study in the eThekweni district that has explored the application of the NCS among the radiographers. Furthermore, the regional hospitals in the eThekweni district serve a larger population and data obtained from these hospitals can be generalised to other hospitals within the district.

In South Africa, morbidity and mortality rates are very high and as such effectiveness and efficiency of diagnostic services is crucial in minimising these rates. Introduction of the NCS by the South African government in 2011 was one of the initiatives to improve quality of healthcare. The most recent move by the government was the gazetting of the National Health Insurance (NHI) Bill in June 2018. The main purpose of the NHI is provision of equitable healthcare services to all South Africans by introducing a universal health coverage (UHC). Imaging services in South African hospitals are some of the areas that will need to improve quality aspects in order to be adequately aligned with NHI plan. The study will improve the quality of healthcare by exploring the factors that impact on the quality

of imaging services and ultimately develop a framework that can be used to manage quality in imaging departments.

Imaging services play a major role in modern healthcare and quality of care depends to a large extent on the effectiveness and efficiency of these services. The quality of imaging services varies depending on where one is situated in the world and African countries have experienced the worse cases over the years. In South Africa, challenges have resulted in long waiting queues (Rauf *et al.* 2008: 43c). In its intentions to achieve the Millennium Development Goals (MDG), South Africa adopted the National Development Plan (NDP) 2030 (National Planning Commission 2013: 14). The NDP 2030 guides the National Health Strategic Plan whose aim is to achieve a long and healthy life for every South African (WHO 2017: 1). A quality framework is essential for imaging services so that imaging departments offer an improved service to the patients.

It is impossible to offer good quality of healthcare without serious consideration for quality. Quality of healthcare is generally a new concept in the world at large but the United Nations (UN) and the United States (US) have taken major strides towards improving healthcare quality in the past two decades (Whittaker *et al.* 2011: 61). According to the WHO, indicators of risk factors for most conditions are higher in African countries than in other parts of the world (WHO 2014: 103). These high-risk factors affect both mortality and morbidity rates and result in high burden of diseases in African countries. South Africa is no exception to these high rates, and this has resulted in major challenges in the achievement of the MDGs 2030.

The lack of literature on research carried out in quality of imaging services in South Africa suggests that this area is neglected. A study conducted in Ghana (Gawugah 2016: 18) aimed at developing a framework for quality in imaging departments in Ghana. The study culminated in the development of a quality framework with mainly four themes being role of radiography staff in quality, role of radiography management, roles of quality and safety committees as well as ensuring

satisfaction of patients with service delivery. However, this study was only conducted in one hospital and the opinions and views of doctors and QA Managers were not obtained. The current study was conducted in four regional public hospitals within the eThekweni district. Further to this the study involved patients, radiographers, doctors, Radiography Managers and QA Managers thus providing rich data on various aspects relating to quality in imaging departments.

1.2 PROBLEM STATEMENT

Diagnostic imaging services in the eThekweni district are faced with a multitude of challenges affecting quality. Patients are exposed to unnecessary radiation dose due to avoidable image repetitions and in addition like the rest of South Africa there are long waiting times (Rauf, Blitz, Geyser and Rauf 2008: 43c). Unnecessary radiation dose poses patients and staff to cancer and long waiting times have a negative effect on patient management by doctors. This is further escalated by poor communication between healthcare workers. Furthermore, there is a need to understand the expectations of the patients and those financing medical imaging services. In addition, delays in healthcare cost patients heavily (de Cuevas *et al.* 2016: 3) and also result in poor quality of life (Tricco *et al.* 2014: e570) and premature avoidable deaths (Lange and Mori 2010: 222).

The South African government has acknowledged inadequacy of quality and has taken a number of steps in improving the quality of healthcare including the introduction of the NCS (Department of Health 2011: 5). The understanding and implementation of the NCS by all healthcare professionals is core to the improvement of healthcare quality. Due to the paucity of studies that have examined medical imaging staff in the eThekweni district a study conducted amongst the nursing staff in the eThekweni district was examined. The study revealed that the nursing staff in private hospitals did not understand the tool used for licensing of the healthcare institutions (Chellan and Sibiya 2018: 515) and in

the current study the researcher will assess how the radiographers understand the tool used to license diagnostic imaging departments.

There is a paucity of studies relating to quality in the imaging departments in the eThekweni district. The most recent study known to the researcher that investigated the factors affecting quality in a radiography department was conducted in Ghana (Gawugah 2016: 14). The current study is a replication of the same study, but as recommended by the author of the Ghanaian study, will be executed to include a number of hospitals as opposed to a single hospital. In addition, it is envisaged that due to the different health systems used in Ghana and South Africa, the study will yield different results to those of the study conducted in Ghana.

The current study used a convergent parallel mixed methods design to explore the complex challenges affecting the diagnostic imaging departments. The quantitative strand included a patient satisfaction survey and image reject analysis. On the other hand, the qualitative strand involved face to face interviews with radiographers, doctors, Quality Assurance managers and Radiography managers. The researcher sought to develop a framework that can be used in diagnostic imaging departments to improve quality of services.

1.3 AIM OF THE STUDY

The aim of this convergent parallel mixed methods study was to explore the factors affecting quality in diagnostic imaging departments in order to develop a framework that can be used to improve quality in the imaging departments within the eThekweni District in KZN, South Africa.

1.4 OBJECTIVES OF THE STUDY

The objectives of the study were to:

- Establish image rejection rates and reasons attributing to image rejection.

- Investigate levels of patient satisfaction in the imaging departments.
- Assess the knowledge of radiographers about the National Core Standards
- Assess the factors affecting quality in imaging departments.
- Explore quality improvement strategies that can be employed in imaging departments.
- Develop a framework that can be used to improve quality in diagnostic imaging departments in the eThekweni District.

1.5 RESEARCH QUESTIONS

1.5.1 Primary research questions

There was a primary research question aligned to the aim of the study and this question was as follows:

What are the factors influencing quality of care in imaging departments in the eThekweni District of KZN?

1.5.2 Secondary research questions

Each of the objectives had a specific secondary research question aligned to it which helped to shape the research methodology and approach. The following were the secondary research questions aligned to each objective:

- What factors contribute to image reject rates?
- To what extent are the patients satisfied with the service delivery in imaging departments?
- What are the perceptions of radiographers regarding the tool currently used in licensing inspections?
- What are the factors that affect quality in imaging departments?
- How can quality be improved in imaging departments?

1.6 SIGNIFICANCE OF THE STUDY

The current study helped in enhancing quality in imaging departments in regional hospitals of the eThekweni district. Exploration of the factors influencing quality of services in imaging departments in the eThekweni District will produce both theoretical and practical advantages and these are discussed below.

1.6.1 Theoretical significance

The study was the first one of its kind to be conducted in South Africa and will therefore, contribute new knowledge with respect to quality in diagnostic imaging departments. The latest study known to the researcher on quality of care in the eThekweni District involved four private practices (Chellan and Sibiyi 2018: 502). This study revealed that the nursing staff in participating hospitals had partially implemented the NCS and the Batho Pele principles.

Furthermore, the methods of data collection that will be used in this study will be useful in producing rich data. A mixed methods design ensured that rich data was collected. Such a method of data gathering can be useful in understanding complicated issues and bring about solutions to serious problems (Curry, Nembhard and Bradley 2009: 1442).

This study has made a great contribution to the body of knowledge relating to quality of health care in general. This is more so as research in health care quality is a relatively new area especially amongst developing countries like South Africa (Whittaker *et al.* 2011: 61).

1.6.2 Practical significance

It is anticipated that the framework will assist in ensuring that Total Quality Management (TQM) is undertaken in all regional hospitals in the eThekweni

District. TQM ensures continuous quality improvement and is based on training all staff members of an organisation on quality management (Cirnu 2017: 57).

This study will therefore help in enhancing quality in imaging departments in South Africa and beyond. It is therefore envisaged that the study will assist imaging departments to achieve better quality of care and will further assist in achievement of the NCS.

Chellan and Sibiya (2018: 502) found it necessary to design a clinical audit tool that could be used by private hospitals in the eThekweni District. The final product for the current study was the production of a practice framework that can be used to enhance quality of health care in regional hospitals in the eThekweni district of KZN.

The majority of South Africans use public health care establishments and most of the public healthcare institutions in the eThekweni District are regional hospitals. District managers will be able to use the practice framework produced by this study as a benchmark tool among various hospitals in the eThekweni District. QA Managers in hospitals will use the envisaged framework to ensure that all stakeholders participate in quality improvement endeavours. Patients will be the primary beneficiaries when all stakeholders understand their roles and act accordingly. It is further envisaged that application of the practice framework will result in reduced image reject, better communication amongst healthcare workers, better equipped waiting areas and shorter waiting times.

In addition, the South African government has undertaken a number of efforts to improve the quality of healthcare without much positive results (South Africa 2011: 5). This is an indication that many changes introduced have not been managed well and thus necessary information was not filtering down to the workers at ground level. The study intends to close such gaps by producing a framework containing clear and simple roles for all stakeholders in the diagnostic imaging departments. The envisaged framework will also be a useful tool to filter information based on

government legislative frameworks such as the NCS and the newly gazetted National Health Insurance (NHI) Bill.

1.7 STRUCTURE OF THE THESIS

This thesis is presented as follows:

CHAPTER 1: OVERVIEW OF THE STUDY

This chapter will encapsulate fundamental elements leading to the need to conduct this study in the eThekweni District. In doing this the chapter will provide the background and introduction to the study, problem statement, aim and objectives of the study, research questions as well as significance of the study.

CHAPTER 2: LITERATURE REVIEW

Literature relating to quality of health care as well as literature on various research methods used in exploring quality of health care will be presented in this chapter. This chapter will reveal areas of shortcomings in previous studies in order to identify the gap in literature that the researcher will take advantage of.

CHAPTER 3: CONCEPTUAL FRAMEWORK

A framework that will be used in this study will be presented in this part of the thesis. The reasons for selecting this framework will be provided following a detailed discussion of the framework.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

In this chapter, the design and methodology that will be followed prior, during and after field work will be documented. Issues relating to the study design, setting, sampling process (including sampling technique, and inclusion and exclusion

criteria), data collection process, pre-testing of the data collection tools, data analysis, trustworthiness and ethical consideration will all be described.

CHAPTER 5: PRESENTATION OF RESULTS: QUANTITATIVE DATA

This chapter will present data on results collected during the quantitative strand of the study. These results will entail findings from the patient satisfaction survey as well as the film/image reject analysis.

CHAPTER 6: PRESENTATION OF QUALITATIVE RESULTS

Results from data collected during the qualitative strand of the study are presented in this chapter. Face to face interviews were held with doctors, radiographers, Radiography Managers and Quality Assurance Managers.

CHAPTER 7: MIXING OF QUANTITATIVE AND QUALITATIVE DATA

The primary researcher mixed the quantitative and qualitative results and presented the mixing of the two strands in this section.

CHAPTER 8: DISCUSSION OF RESULTS

A discussion on both strands of the study is presented in this chapter. The data obtained was compared to studies by other researchers and furthermore, explanations for trends observed were also made in this section of the study.

CHAPTER 9: DEVELOPMENT OF A QUALITY FRAMEWORK FOR RADIOGRAPHIC SERVICE DELIVERY IN REGIONAL HOSPITALS IN THE ETHEKWINI DISTRICT OF KWAZULU-NATAL, SOUTH AFRICA

This chapter demonstrates how the data collected and literature reviewed was used to develop a framework. The framework itself will be presented in this part of

the dissertation. Pillars of the framework as well as how the framework can be used are explained in this chapter.

CHAPTER 10: LIMITATIONS, STRENGTHS, CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY

Limitations and strengths of the study are presented in this chapter. In addition, conclusions and recommendations based on key findings of the study are discussed here.

1.8 CHAPTER SUMMARY

This chapter has presented background and introduction to the study. In addition it has presented a problem statement, aim and objectives of the study, research questions as well as significance of the study. The study explored the factors affecting quality in imaging departments within the eThekweni District. The next chapter presents the literature review and will focus on positioning the study amongst other studies previously conducted on quality of health care.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter aims to provide literature on quality of services in medical imaging departments. The chapter further considers gaps in literature whilst also striving to locate the study within the body of knowledge in quality of medical imaging services. Furthermore, the chapter is presented in seven broad areas including healthcare quality, quality of healthcare in Africa, A South African perspective for Quality Assurance, the role of medical imaging in a healthcare centre, quality of services in medical imaging departments and structural elements for quality in medical imaging departments. Each of these broad areas is dissected further into subsections for example the section on quality of services in medical imaging departments is further discussed under more specific subsection like adequacy of building, availability of equipment, adequacy of waiting rooms, organising and staffing as well as waiting times.

Most of the sources used were obtained through the library site of the Durban University of Technology and search engines such as PubMed, Cochrane, Google Scholar, Scopus, Science Direct and others. Search terms used were quality, image reject analysis, patient satisfaction, quality assurance, service delivery, quality management. Some of the sources used were obtained from reference lists of others.

2.2 HEALTHCARE QUALITY

The International Organisation for Standards defined quality as “a degree to which a set of inherent characteristics of an object fulfils its requirements”. Quality in healthcare is the extent to which health services provided to the population intensify the chances of anticipated health results (Kohn, Corrigan and Donaldson

2001: 13). Furthermore, in diagnostic imaging quality activities are delivered in terms of quality control, quality assurance and the quality management system.

It is known that the quality of healthcare is poor in most countries of the world including South Africa (Whittaker *et al.* 2011: 63; Mogashoa and Pelser 2014: 143). Quality of medical imaging services in the current study is concerned with patient satisfaction, effective communication between various stakeholders in the system, reduced image rejection rates, compliance with NCS, reduced waiting times and quality of images. On the other hand, the literature search has revealed a paucity of studies in South Africa on quality in the diagnostic imaging departments. Furthermore, the South African government is constitutionally obligated to a quality service to the citizens of South Africa (Stuckler, Basu and Mckee 2011:165). In addition, the South African government has embarked on numerous initiatives to improve quality of healthcare. These include accreditation of healthcare establishments in 1993 followed by licensing of healthcare establishments in 2001 as well as introduction of the NCS in 2011 (Whittaker *et al.* 2011: 62). In recent years, initiatives in the form of models and frameworks have been developed to improve healthcare (Coles *et al.* 2017: 3). On the other hand, models and framework relating to quality of services in diagnostic imaging departments in a South African context are very limited and the current study is the first one of its kind to be undertaken in the eThekweni district.

Studies relating to management of delays in diagnosing are very rare in South Africa. However, there is evidence pointing out that delays in imaging services impact negatively on diagnosis (Car *et al.* 2016: 4). With communicable diseases, poor quality in imaging system result in further infections thus complicating the disease even further (Uys, Warren and Helden 2007: e757). Whilst most delays in diagnosis have been attributed to imaging service (Car *et al.* 2016: 1), none of the studies have investigated the causes for these delays in imaging departments. The current study therefore seeks to unearth the factors affecting quality in imaging departments by using a mixed methods design.

The most important dimensions of healthcare quality are explained by Madar (2019: 57) and these include safety, professional competence, relevance, efficiency, effectiveness, acceptability, accessibility, continuity, patient satisfaction and patient collaboration. Diagnostic radiography uses ionising radiation to produce images of human anatomy and as such radiation safety of patients, radiographers and the public is very important (Adler and Carlton 2007: 45). In addition, with regards to safety, both the patient and healthcare professional should be committed in ensuring that potential risks are excluded. Professional competence is about the knowledge, skills and capacities that should be possessed by all healthcare workers including support staff and managers. In terms of accessibility, the services rendered must meet the expectations of patients and those financing the services.

Managers in the KZN Department of Health and in the eThekweni District will have to take very serious decisions when improving the quality of care using the developed framework. In explaining the relevance of service, Cirnu (2017: 57) states that services rendered must meet the needs of patients. With respect to efficiency, the services must meet hope-for results without over-costing the healthcare establishment. Furthermore, image retakes contribute to unnecessary radiation exposure to patients, results in resource wastage and thus reduced quality of services in the imaging department (Lin *et al.* 2016: 1). It is for this reason that the study included image/film reject analysis. The main areas published about healthcare quality included quality improvement strategies (Groene *et al.* 2008; Mainz 2003; Tricco *et al.* 2014; Coles *et al.* 2017), factors influencing quality of healthcare (Mosadeghrad 2014: 80) and Total Quality Management (Cirnu 2017) and a few of these factors are explained below.

2.2.1 Quality improvement strategies

In healthcare quality, it is important to apprehend and overcome contextual barriers to quality improvement in order for effective implementation of such initiatives to

be realised. Quality improvement strategies should be uniquely designed to achieve the Universal Health Coverage (Mensah Abrampah *et al* 2018: 5). In addition, the intention of a quality improvement strategy should be to find a solution resulting in an immediate change to a problem confronting healthcare delivery (Larson, Duncan, Nagy and Krukskal 2014: 562). There is a need for diagnostic imaging departments to ensure that steps are taken to investigate challenges confronting these departments so that long lasting solutions can be found. On the other hand, the South African Department of Health recognises Quality Improvement as the ability of the healthcare system to obtain the best results within available resources (Department of Health 2012: 5). The Department of Health further explained that Quality Improvement should be an ongoing process with the intention to improve processes so that they are effective, efficient, safe, patient-centered, reliable and timely (Department of Health 2012: 9). The South African Department of Health (2012: 10) further explains that the Quality Improvement cycle should involve steps as illustrated in Figure 2.1.

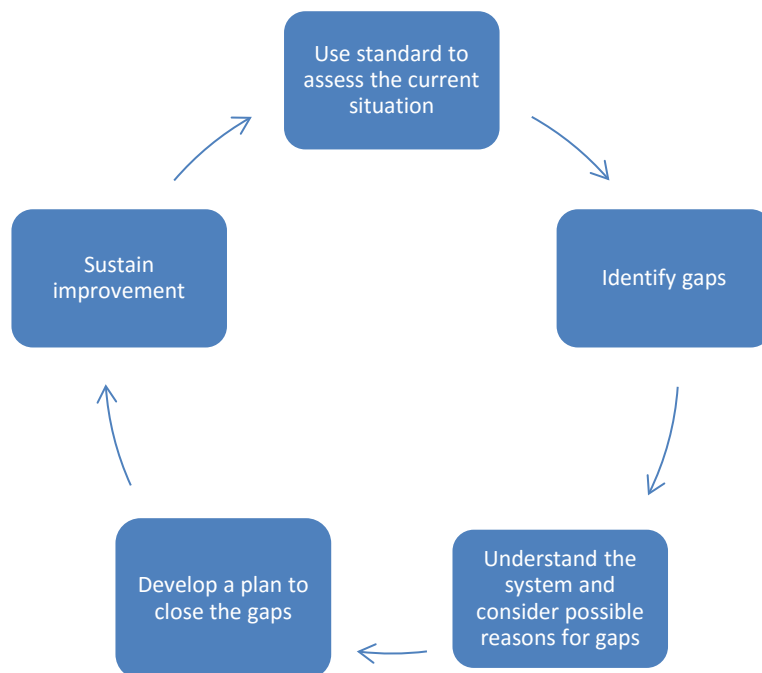


Figure 2.1: Quality Improvement cycle (South African Department of Health 2012: 9)

One of the interventions in improving quality was reconsidering deviations from protocols in management of certain conditions. These deviations may result in unnecessary requests for image examinations. The example is requesting chest x-rays to diagnose bronchitis in paediatrics (Reiter *et al* 2018: 2). The study by Reiter *et al* (2018: 4) revealed that this deviations from protocol resulted in unnecessary radiation exposure to patients, waste of scarce resources and longer hospital stay. Furthermore another strategy was used in a digital imaging department where the algorithms were correctly adjusted thus resulting in a significant enhancement of image quality properties such as overall image look, latitude, edge enhancement and contrast (Sandoval, Valenti, Bateman, Norris and Mlady 2016: 2).

2.2.2 Involvement of stakeholders

Batalden and Davidoff (2007: 2) defined improvement of the quality of healthcare as concerted efforts by all stake holders to ensure changes that lead to improved patient outcomes. Therefore, it is important for all stake holders to be involved when planning to improve healthcare quality. Such stakeholders would include patients, patients' family members, researchers, planners, healthcare professionals, payers and educators. In addition, it is important for all stakeholders in a healthcare setting to embrace change on a daily basis in order for healthcare to realise its full potential (Batalden and Davidoff 2007: 2). Efforts from all stakeholders are particularly important in healthcare because providers of patient care are not able to ensure that patients comply with "ISO 9000" standards (Winterberg 2001: 352) as the human beings are more complicated to use such standards as used in goods. The current study produced a framework which introduces new ways that can be used to improve or maintain quality in imaging departments. Batalden and Davidoff (2007: 2) continue to explain that when a number of stakeholders work together to improve quality the benefits are better professional development, improved patient and population outcomes as well as better performance of systems.

2.2.3 Factors influencing healthcare quality

Factors that affect quality of healthcare are dependent upon many variables and are usually different in each setup. A study by Mosadeghrad (2014) investigated factors influencing quality of healthcare and grouped the factors influencing healthcare quality into three categories. These were patient factors and factors affecting healthcare provider and are both discussed below.

2.2.3.1 Patient factors

Patient factors included patient socio-demographic factors, patient cooperation and types of patient illness. The interaction between the patient and the provider is influenced by the patient socio-demographic factors and these in return affect the quality of services. Communication is also affected as patients may battle to understand the healthcare professional depending on whether the patient can speak the language understood by the healthcare professional (Mosadeghrad 2014: 80). In South Africa, there are multiple languages used and at times it becomes extremely difficult to communicate effectively. This is further exacerbated by the fact that South Africa has become home to many people from foreign countries. In the United Kingdom, the government has put in place strategies to enhance communication between patients and service providers (Booth 2008: 323).

Co-operation by patients is also very important as this improves the level of healthcare quality. The main challenge is that when patients do not follow instructions, the purpose is not achieved, and this has a negative impact on quality of care (Mosadeghrad 2014: 81; Winterberg 2001: 352). The result is deterioration in the quality of care (Ferlie and Shortell 2001: 281). In radiography, lack of cooperation by patients may lead to patient movement during the exposure. This can result in unsharpness (image blur) of the image thus making it difficult to diagnose using such an image. This is usually corrected by taking a repeat image and the downside of this would be increased radiation dose to the patient.

2.2.3.2 Healthcare provider factors

The healthcare provider factors are described by Cai *et al* (2015: 11) as those factors based on the healthcare system or the clinicians. Healthcare providers develop healthy relationships with their patients through personality characteristics such as respect, willingness to help, reliability, intelligence and confidence (Mosadeghrad 2014: 81). On the other side the absence of the above-mentioned characteristics in healthcare providers results in severe suffering to recipients of healthcare services.

In South Africa, there is a huge burden of disease due to a number of factors including the Human Immunodeficiency Virus (HIV). As such the healthcare workers are extremely overwhelmed and thus lack the time to improve their communication with patients (Chopra *et al*/2009: 1026). On the other hand, globally patients are slowly becoming the centre of service delivery and this is a legislative requirement in many countries including the United Kingdom (Renedo, Marston, Spyridonidis, and Barlow 2015: 19). It is also true that the problems experienced by the healthcare professionals negatively affect the quality of care provided by the healthcare provider. The current study elicited information on the behaviour of healthcare professionals so as to determine those factors that could result in delays during patient diagnosis. The knowledge and skills possessed by healthcare providers also assist in improving the quality of care provided. In order for this to happen, the management of an organisation needs to be supportive, undertake good planning, education and training. The employees also need to be well managed (Mosadeghrad 2014: 85) to ensure that services are of good quality.

2.2.4 Total quality management

Total Quality Management (TQM) is a strategy used to improve satisfaction of customers and functionality of the department by rendering quality services through involvement of stakeholders, teamwork and continuous improvement of structures and processes (Mosadeghrad 2014: 320). In addition, the quality of any service

including healthcare depends on the satisfaction of customers (Cirnu 2017: 57). To ensure a properly functioning TQM, a quality committee including representatives from all cadre categories in the department must be in place and its main duties should be to conduct reviews and evaluations of Quality Assurance in the department (Delis et al 2017: 106). Furthermore, clear support by top management is key for effectiveness of TQM (Mosadeghrad 2014: 323).

2.3 QUALITY OF HEALTH CARE IN AFRICA

Quality of healthcare in African countries has become a major concern due to poor health indicators in most countries (Adindu 2010: 31). The ultimate test of quality in a healthcare establishment is important in ensuring that systems work to the benefit of patients. Joshi (2009: 370) suggests that this function should be dedicated to a group of individuals on a full-time basis. A patient satisfaction survey was conducted in Eastern Ethiopia (Abdosh 2006:1) on patients hospitalised in major referral hospitals in that region of the country and just more than 54.1% of patients were satisfied with quality of care rendered. This rate was relatively lower than 68% observed in a study in Bangladesh (Aldana, Piechulek and Al-Sabir 2001: 514) performed around the same period as the afore-mentioned study. In this study, general hospital cleanliness, politeness of staff and waiting for services scored the lowest.

Amongst all the challenges facing the African health care, there are two that stand out. The first one is that most Africans rely on public health care. The public health care is faced with challenges such as insufficient budget resulting in challenges like staff shortages and poor infrastructure. The second challenge is that African countries lack well established and good performing private markets, and this results in more strain to the already suffering public system (Ataguba and McIntyre 2012: 4). Although a high response rate of 518 patients was obtained, it is unclear how the community was represented as the sampling strategy used has not been explained. In this study, a stratified random sampling and a purposive sampling

technique was used for quantitative and qualitative strands respectively. These strategies were used to ensure that the populations for both strands were adequately represented giving all subjects in the community an equal opportunity to participate in the study.

Countries situated in Sub-Saharan Africa are experiencing an increase in chronic diseases together with a high prevalence rate of infectious diseases (Boutayeb 2006: 196). Katende *et al.* (2015) conducted a study to assess the burden of chronic diseases together with readiness of hospitals in managing these diseases. The study found that the readiness of lower level healthcare facilities was lesser than that of higher-level facilities. Recommended areas of improvement were introduction of guidelines when dealing with chronic diseases, availability of essential diagnostic machines and medicines, training of healthcare workers especially nurses and non-medical employees and improvement of referral systems. The study did not include a qualitative phase and thus reasons for lower performance could not be established. In addition, the recommendations made were mainly theory based rather than obtaining them from the participants.

2.4 A SOUTH AFRICAN PERSPECTIVE FOR QUALITY ASSURANCE

In South Africa, quality is enforced through a number of imperatives including the National Health Act (Act number 61 of 2003), Office of Health Standards Compliance (OHSC) and the NCS. The OHSC embraces the values and principles of the South African constitution as it seeks to protect the rights and freedom of the people. The basic principles guiding the OHSC are that the regulations should:

- Foster greater accountability.
- Be clear and transparent.
- Be targeted.
- Be applied consistently and produce reliable decisions.
- Interventions of the regulations must be proportionate.

The NDP seeks to eradicate poverty and diminish inequality by the year 2030. In this plan, strategies to improve behaviour of the citizens are suggested (South Africa. National Planning Commission 2011: 11). Furthermore, a recent study in the eThekweni District indicated that nursing staff in private hospitals were not aware of the provisions of the NCS (Chellan and Sibiya 2018: 17). The NHI was gazetted in 2018 and aims to transform the South African health care system so that everyone has a right to good quality of healthcare regardless of their socio-economic level. On the other hand, the NCS framework aims to develop a common definition for all healthcare establishments in South Africa. These standards were used to frame the current study and are explained below.

2.5 THE ROLE OF MEDICAL IMAGING IN A HEALTHCARE CENTER

Medical imaging is responsible for the majority of man-made radiation (Balogh, Miller, and Ball 2015: 55). It is, therefore, quite critical that its role in the patient management chain be clearly understood. Radiography is responsible to inform the disease process as early as possible during the diagnostic stage of the patient and unlike other diagnostic tools, it should be accompanied by an interpretation which is dependent on the skill of the radiologist (Larson and Langlotz 2017: 992). There are many other factors on which the interpretation depends including the quality of the image itself. In a clinical setting the process of patient management can be divided into diagnosis and treatment (Pauker and Kassirer 1980: 1114). The diagnostic procedures assist the doctors in understanding the reasons for signs and symptoms experienced by the patient and further helps in providing the doctors to select the best treatment for the disease. The diagnostic process may reveal the type, the size, the extent and other features of a disease (Larson and Langlotz 2017: 993) and as a result the quality and promptness of the diagnostic information is critical.

Diagnostic radiography is the essential part of information gathering that precedes treatment of the patient. When a radiography request is completed, the imaging

department is requested to answer a clinical question in the mind of a team of doctors managing the patient. In other words, the clinical team needs to rule out a clinical condition or confirm that the patient is suffering from a particular disease or combination of diseases (Kassirer and Gorry 1978: 251). The appropriateness of an imaging process may be affected by various factors including the availability of imaging modalities, and this is usually determined by the clinical team although this would be based on the report provided by the radiologist's report. Another important aspect of patient management is selection of an adequate modality by the clinical team (Larson and Langlotz 2017: 994). The radiography team has a responsibility to interrogate the adequacy of the requested modality considering the information provided in the request form. On the other hand, the radiology team should be able to advise on the best modality and protocols necessary for diagnosis of the suspected disease. This should be done in communication with the radiologist (where possible) and the requesting doctor. This is particularly important as the radiographer dispenses ionising radiation to the patient. The skills, knowledge, attitude and experience of the radiographer and or/ radiologist are crucial when providing such advices. The involvement of the patient in deciding on the appropriateness of the imaging modality is important as the radiology team might want to ask the relevant questions not appearing on the request form (Larson and Langlotz 2017: 994). The communication between the patient and a member of the radiology team thus becomes important in ensuring that the information provided by the patient is adequate and accurately understood by members of the imaging team.

2.6 QUALITY OF SERVICES IN MEDICAL IMAGING DEPARTMENTS

Quality of services in imaging departments requires that the internal and external clients be satisfied with service delivery and that the imaging department is compliant with statutory and regulatory requirements (Abdulkadir 2020: 2). In considering the quality in an imaging department, patients are usually concerned about cost of service, accuracy of reporting, reporting timelines, effectiveness of

communication, waiting periods, radiation exposure and respect for dignity (Joshi 2009: 101). Doctors are usually more concerned about accuracy and reliability of the reports as well as timelines of reporting to ensure rapid diagnosis of patients. In terms of the management of the hospital quality of imaging services relates to minimum wastage of consumable materials, maximum utilisation of equipment and manpower and compliance with statutory requirements. Complying with statutory requirements means planning of facilities as per the requirements of South African Health Products Regulatory Authority (SAHPRA), safety of staff, patients and the public and compliance with code of medical ethics. Optimisation of radiation protection is key in ensuring radiation protection (Almen and Bath 2015: 1). In addition, one of the ways by which the radiation protection can be enhanced is application of the image reject analysis.

The image reject analysis is used to identify percentages of rejected/repeated images in an imaging department. Furthermore, the reject analysis helps to guide the training of radiographers, impacts on departmental workflow and improves the efficiency of the department (Atkinson, Neep and Starkey 2020: 72). Whether an imaging department uses a conventional film processing system, a computed radiography system (CR) or a digital radiography system (DR) to process images, the image reject analysis remains an important tool to measure the existence of sound management systems in the imaging department. In addition, the reject rate analysis has implications for management and continuous training (Hofmann, Rosanowsky, Jensen and Wah 2015: 1). In the current study, a retrospective review of image reject data collected over three months was undertaken. The timing was different to that of Hofmann, Rosanowsky, Jensen and Wah (2015: 1) in which data for a single month was analysed. Data collected over a longer period makes it possible to observe trends over time and thus is more reliable. On the other hand, the researchers in a Norwegian study (Monfared, Abdi and Saber 2007: 38) were involved in evaluating and categorising images and were able to discuss suitable categories when in doubt. Reasons for rejection of images may

include inadequacy of exposure factors, positioning and technical challenges and patient related problems (Monfared, Abdi and Saber 2007: 38).

Throughout the world there has been a move towards ensuring an external QA process which is measured against agreed, well tested standards. In South Africa, the NCS are used to measure quality of care in all sections of a healthcare unit. In addition, to ensure compliance with its standards pertaining to a number of quality tests, the SAHPRA Board of the National Department of Health inspects all healthcare facilities with imaging equipment. The external QA cannot serve the purpose of examining the specific areas of quality, for example accuracy and reliability of reports may be verified by the treating physician. It is for this reason that the study qualitative part of the study included interviews with doctors and is in line with Hammick's view (1995: 140) that qualitative research is important in quality studies.

The hospitals should put in place an internal QC system with the view to address the quality of the structure, process and the outcome. Joshi (2009: 103) alludes to the fact that the quality of outcomes determines the satisfaction of patients and for this reason a patient satisfaction survey was conducted as part of the current study. Further to this, Almeida *et al.* (2012: 16) revealed during their study that patient satisfaction is a critical component of evaluation of quality. In addition, Joshi (2009: 103) explains that other important structural elements of quality are safe buildings, availability of equipment, adequacy of waiting rooms, organisation and staffing.

In South Africa, radiographers and doctors interact daily in a transactional manner (Makanjee, Berg and Hoffmann 2014: 155), thus communication between the two cadres of healthcare is highly important. In addition, the conceptual framework used to guide the current study explains that the clinicians depend on the imaging department for radiological diagnosis of patient conditions (Larson and Langlotz 2017: 992). Both the Quality Improvement Guide (South Africa 2012: 8) and Larson

and Langlotz (2017: 997) emphasise the need for teamwork in the provision of healthcare and the Radiography Manager (RM) needs to be instrumental in monitoring this teamwork, not only amongst members of the department but also between the department and its customers. On the other hand, the RM should drive the development of protocols so as to ensure that physicians are clear about accessing a range of modalities within the department. Furthermore, image acquisition protocols should be developed so that radiographers and radiologists are clear about the techniques to be performed for all examinations. In addition, the RM should ensure continuous accessibility of services. In undertaking this task, the RM should always put in place strategies to ensure availability of staff.

Image quality is a very important element of quality in an imaging department. A study by Utami (2020: 14) revealed that there was significant association between image quality and satisfaction of the requesting doctor. In addition, Sebelego, van der Merwe and du Plessis (2019: 5) showed that positioning was incorrect for 70% of the images and four-sided collimation was not achieved in more than half of the images due to incorrect centring points. It is important to note that whilst some qualities of the image can be changed by the radiographer at the workstation during post processing, images cannot be readjusted once they have been sent to the PACS. For this reason, radiographers should try their best to set correct exposure factors to avoid this challenge (Bontrager and Lampignano 2014: 51; Pongnapang 2005: 2). For this reason, radiographers are to try their best to ensure that the best diagnosis is obtained at the first attempt (Moller 2016: 312). In addition, obtaining the correct image at the first attempt improves patient satisfaction and reduces unnecessary costs for the state (Gijo and Antony 2013: 1481).

Whilst it is generally acknowledged that diagnostic imaging departments represents the largest source of radiation to which the population is exposed, diagnostic radiology continues to fall short of minimising radiation. The main reasons for this are lack of adequate quality procedures and expert medical

professionals that are able to ensure its effective and proficient use (Delis *et al.* 2017: 105). Over years the radiology equipment has technologically advanced in line with complexity of disease trends and the needs of the patients. This has resulted in a steep rise of radiation dose to patients thus calling for major transformation of the quality processes in radiology. The QC that has been known for years has now been replaced by a more inclusive quality system (International Atomic Energy Agency 2010; American Association of Physicists in Medicine 1994). In low- and middle-income countries like South Africa, QC of equipment is often neglected and in some hospitals assessment of equipment quality is only conducted when preparing for inspections for licencing purposes. In South Africa, the quality of equipment is regulated through the SAHPRA Board of the National Department of Health. This board specifies tests to be undertaken on a regular basis. The SAHPRA Board has powers to close radiology departments who do not conform to the set standards in terms of equipment QC.

The International Atomic Energy Agency (IAEA) has been engaged with its member states to move the quality agenda beyond the traditional QC. The intention is to adopt a more comprehensive quality perspective (Delis *et al.* 2017: 105). The International Standards Organisation (ISO) (2015) defines quality as “*degree to which a set of inherent characteristics of an object (product, service, process, system) fulfils requirements (need or expectation that is stated, generally implied or obligatory)*”. Further to this, the World Health Organisation (WHO) stipulates attributes of quality to be effective, efficient, accessible, equitable, safe and patient centred (WHO 2006). The various levels to be included in a comprehensive quality system are QC, QA and Quality Management.

2.6.1 Quality Control

Jones *et al.* (2015: 6660) define QC in diagnostic medical imaging as a continuous process frequently evaluating medical imaging equipment. The main objective of QC is to ensure that a service fulfils the established quality requirements (ISO

2015: 14). It is therefore a tool to compare performance against set standards. It must always be remembered that quantifying performance is only a component of the larger QC process. In South Africa, the statutory SAHPRA Board performs evaluations to ensure that QC tests are completed by all imaging departments. The challenge with this process is that in some institutions these are left until the SAHPRA Board visits such institutions.

2.6.2 Quality Assurance

QA is a process of preventing inaccuracies that may negatively affect quality of care (Delis *et al.* 2017: 106). In diagnostic radiography, the QA activities include the QC procedures. In diagnostic radiography, QA includes aspects of imaging technology such as the imaging room and the design of workflow, selection and purchasing of equipment, installation of equipment, acceptance testing, equipment commissioning, QC, maintenance and support of equipment and disposal of redundant equipment (Delis *et al.* 2017: 106).

2.6.3 Quality Management

ISO 9000 defines quality management as the overall umbrella for all quality concepts including all activities used by organisations to direct, control and coordinate quality. Quality management should include establishing quality policies and objectives. The International Organisation for Standardisation (2015: 14) states that the seven quality management principles are improvement, patient focus, leadership, people engagement, process approach, evidence-based decisions and management of relationships. Ideally in each imaging department an individual should be trusted with the task of ensuring that these principles are in place. The recent adoption of the NCS in South Africa seeks to satisfy the task of ensuring these quality management principles. The current study explored and investigated quality factors within the eThekweni District and proposed a framework that can be used to enhance quality in imaging departments in this part of the continent.

The major indicators of quality in medical imaging as explained by Joshi (2009: 109) are:

- Radiographic image quality.
- Accuracy of image reporting.
- Turn-around times for image reporting.
- Image reject analysis.
- Radiation exposures.
- Usage of contrast media and other drugs.
- Waiting times.
- Adverse reactions and complications arising from procedures.

2.6.4 Structural elements for quality in imaging departments

The structure elements must be provided based on the workload of an imaging facility. The main structures are safety of buildings, availability of equipment, adequacy of waiting rooms, organisation and staffing, availability of materials and engineering services. These elements are briefly discussed below.

2.6.4.1 Adequacy of buildings

The main consideration for safety in an imaging department should be radiation safety and safety from magnetism from magnetic resonance imaging (MRI). For these reasons, general x-ray rooms, computed tomography (CT), and MRI machines should be away from the public (Joshi 2009: 103). In addition to this requirement, these modalities should be reasonably located for quick access by outpatients, inpatients as well as patients from Accident and Emergency unit. It is also important that the availability of space be adequate for the current workload and allow for about 5% to 15% of future expansions. In general, the provisions of the SAHPRA ambit of the Department of Health should be considered when planning new buildings or renovations of existing buildings (Putsep 1981: 426).

In South Africa, the public hospital infrastructure is poor, and in some hospitals, it requires urgent attention. This is mainly due to the non-implementation of the NCS. A study aimed at analysing implementation of the NCS in the Limpopo Province in South Africa revealed that infrastructural challenges were hindering the implementation of the NCS (Mogashoa and Pelser 2014: 153). In addition, staff members complained about working in dilapidated buildings and ablution facilities were below the expected standard.

2.6.4.2 Availability of equipment

To ensure adequate availability of imaging equipment the hospital management should ensure that the equipment is provided according to international norms. It is therefore expected that in terms of x-ray room provision, there should be one room for every 5000 to 20000 x-ray examinations per year (McGibony 1952: 1537). One CT unit should be installed for 1500 to 2500 scans per year. In addition to these machines, mammography, bone densitometry, panography, fluoroscopy, MRI and suitable processing machines should be in place. Regional hospitals in the eThekweni District are the hub of imaging in KZN and neighbouring provinces and thus should contain all these types of machines. However, in many hospitals the CT and fluoroscopy units are non-functional while MRI and bone densitometry machines are non-existent.

2.6.4.3 Adequacy of waiting rooms

The comfort of patients is one of the key role players when examining patient satisfaction (Sari, Indasah and Suprpto 2020: 441) and the current study investigated and explored this aspect further. Waiting space in all sectors of the hospital should be comfortable and must be spacious enough to house patients in wheelchairs and trolleys (Frichi, Jawab and Boutahari 2020: 313). Furthermore, the emergence of highly infectious diseases like the Coronavirus Disease has forced hospitals to separate patients suspected of infections to those that are

asymptomatic or not suffering from any infectious disease (Zhao *et al* 2020: 5). Toilet facilities should be close-by and should accommodate all types of patients including disabled people. In addition, the waiting room for the x-ray department should have drip stands and oxygen supply. Where possible patient comfort should be provided including quality of seats, availability of television and radio and provision of magazines and brochures for imaging procedures (Itri 2015: 1839).

2.6.5 Organising and staffing

All staff in the imaging departments including radiographers, doctors and nurses should be suitably qualified to offer quality services (Silva, Godinho, Silva and Costa 2019: 124). In South Africa, all radiography qualifications are offered as a four-year undergraduate degree. This is a recent requirement by the Department of Higher Education and Training (DHET) and as such some of the qualified radiographers possess a National Diploma in Radiography. In the past few years there has been a national drive for radiographers to further their studies into a Bachelor of Technology in Radiography (B. Tech: Radiography) and a number of radiographers are expected to be in possession of this qualification. In addition, all Radiography Managers are well experienced radiographers, and some are in possession of a B. Tech: Radiography degree. Each regional hospital is also expected to employ the services of radiologists, registrars, nursing staff, porters, cleaners and administration staff like typists and clerks. According to McGibony (1952: 86), the requirements for radiographers should be four per 100 bed hospital, nine per 300 bed hospital, 15 per 500 bed hospital, 18 per 600 bed hospital and 20 per 700 bed hospital.

2.6.6 Waiting times

Waiting time is the time lapse between the arrival of a patient in the diagnostic imaging department and the time the patient is provided with the report (Ugwuanyi, Chiegwu, Eze and Okoli 2017:597). Long waiting times increase the dissatisfaction of patients and factors that lead to long waiting times must be identified with the

view to act on them. The duration of the waiting times is dependent upon factors such as long queues, staff shortages and motivation, staff expertise and experiences and adequacy of systems including equipment (Muchuki 2019: 31). Waiting times must be closely monitored to enhance service delivery and improve patient satisfaction. In addition, a study by Salsabila and Dachyar (2020: 3627) revealed that changing to a digital radiography system accompanied by Picture Archiving and Communication System (PACS) reduced waiting times by 81%.

2.6.7 Monitoring quality in medical imaging departments

There is a need for imaging departments to put systems in place to measure the level of quality rendered (Delis *et al.* 2017: 106). Measuring quality must be conducted against a set of agreed standards. The NCS are used in South Africa to measure and evaluate provision of quality healthcare. The important aspects when monitoring quality in diagnostic radiography are documentation, performance indicators and dosimetry which are explained briefly below.

2.6.8 Documentation

For any quality system, a manual plays a very important role although the documentation process itself is time consuming. The manual can be used by staff in the department as a resource for standards and policies intended to enhance quality in various aspects of the department. Most of the content for such a manual should be similar for radiography departments in public regional hospitals within a district. It is envisaged that the framework developed through the current study will be a guiding document in further developing such a manual. The manual can also be used as evidence of compliance with quality requirements. To ensure that the manual is effective, it must be updated by all stakeholders in the team (Delis *et al.* 2017: 106).

The main aspects to be included in the manual, as developed by some members of the IAEA, are leadership and strategy (mission and vision, demographics of the

population served, organisation of the department, strategic planning and action planning); resources (human resources and qualifications, infrastructure in terms of rooms and facilities, imaging equipment, IT systems and infrastructure, additional equipment and financial resources); radiation safety (radiation safety committee, radiation safety rules and radiation safety manual); quality (QA and QC, QA Committee, plans, actions and records of continuous improvement, incident reporting and documentation control) and clinical guidelines (Delis *et al* 2017: 105).

2.6.9 Performance indicators

The popular quotation by James Harrington (a quality pioneer) is very important when quality is to be improved. The quote reads: *“Measurement is the first step that leads to control and eventually to improvement, if you can’t measure something, you can’t understand it. If you can’t understand it, you can’t control it. If you can’t control it, you can’t improve it”* (Delis *et al* 2017: 106). Any quality system must possess clearly distinct indicators so that it would be easy for it to be measured. Departments should identify the bottlenecks that challenge quality and include them in the strategy to improve quality of care.

Ramlaul and Vosper (2013: 252) and Joshi (2009: 109) provide quantifiable quality measures as:

- Numbers and costs of diagnostic procedures.
- Success and complication rates for procedures.
- Incidence rates and survival rates for common medical conditions such as stroke, coronary artery disease, tuberculosis and cancer.
- Disease detection rates when performing screening tests like mammography.
- Results of local satisfaction rates (patients and doctors).
- Number of complaints received from patients.
- Number of complaints received from clinicians.

- Instances of violation of regulations.
- Rate of films wastage.
- Defects detected by the medical audit committee.
- Frequency of investigations postponed or cancelled
- Response time in emergency cases after hours.
- Time taken in generating and communicating the reports.
- Instances of breach of radiation safety.
- Instances of breakdown, repairs and downtime of equipment.
- Patient or procedure identification errors.
- Number of equipment under regular QC programme with established procedures.
- Number of examinations with local doses.
- Number of hours of training per staff member per annum.
- Number of standardised radiological procedures with established examination protocols.
- Turnaround times for different examinations and patients.

2.6.10 Dosimetry

Radiation dose is the unwanted product in the process of image production (Delis *et al.* 2017: 107). The radiation dose should be minimised whilst ensuring that the image quality is not compromised (Carlton and Adler 2013: 141). In diagnostic radiography, dosimetry is used to measure equipment performance, developing guidance levels like Dose Relative Levels and measuring patient specific dosimetry. Dosimetry can therefore be used to check performance against the standards.

2.6.11 Clinical audits

The IAEA prescribes that the audit panel consists of people with expertise and experience in all aspects and modalities in the radiography departments. The

Council of the European Union (2013: 6) defines clinical audit as *“a systematic review of medical radiological procedures which seek to improve the quality and outcome of patient care through structured review, whereby medical radiological practices, procedures and results are examined against agreed standards for good medical radiological procedures with modification of practices, where appropriate, and the application of new standards, if necessary”*. Clinical audits are a process of intentionally finding faults and the intention is for faults to be corrected (Delis *et al.* 2017: 107). The auditors involved in clinical audits should be independent of the process or procedure to be audited and clinical audits should be an integral part of quality improvement in any facility.

2.7 CHAPTER SUMMARY

This chapter has presented an in-depth literature review around QA in healthcare settings. Global, African and South African aspects of quality in imaging were explored. The major characteristics of quality discussed were professional competence, relevance, safety, efficiency, effectiveness, acceptability and continuity. Further to this, quality improvement strategies have been examined. Moreover, factors influencing healthcare quality including patient factors, healthcare provider factors and environmental factors were investigated. This chapter also noted the paucity of studies relating to quality in imaging departments especially in Africa. The next chapter discusses the research design and methodology.

CHAPTER 3: THEORETICAL FRAMEWORK

3.1 INTRODUCTION

Theoretical frameworks are used by researchers to guide/frame the studies and therefore it is important for researchers to understand very well what is going on around their areas of study (Grant and Osanloo 2014: 13). In quality research, the integration and sustainability of research outcomes depend on the degree to which its underpinning theory is scientifically confirmed (Portela, Lima, Martins and Travassos 2016: S5). Michie *et al* (2005: 28) further explained that theory links connected concepts and proposals capable of clarifying or predicting events based on the specification of relationships between variables. This is important in order to avoid broad application and testing of findings. For the current study, clarification of variables existing within a community as well as those within the setup of a healthcare establishment was deemed important in order to answer the research question.

A theoretical framework establishes boundaries for a research study and the researcher must ensure that the study is focused within those boundaries. It serves as a guide on which to build and support the study. In addition, it must explain how the researcher philosophically, epistemologically and methodologically frames the entire study (Grant and Osanloo 2014: 13). The aim of the current study was to explore the factors affecting quality in medical imaging departments within the eThekweni District. These factors might relate to the characteristics of the individual and the community from which they emerge whilst others may relate to what happens to the individual once they have access to a healthcare establishment. Based on this background, two frameworks guided the study to ensure that all the possible factors are explored. One was the NCS adopted by the South African

National Department of Health in 2011 and the other one was the framework for quality management in radiology departments as suggested by Delis *et al.* (2017). The NCS framework was selected so that it could be used to base information relating to the National Core Standards throughout the thesis. It is the document in which the standards are well explained and as such was found suitable to base radiographers' understanding of the standards. On the other hand the framework by Delis *et al.* was selected due to its ability to explain core elements relating to quality in a medical imaging department. The framework by Delis *et al.* further outlines the differences between Quality Control, Quality Assurance and Quality Management (Delis *et al.* 2017: 105). In addition, the Delis *et al.* framework also suggests a Quality Manual that can be used to enhance quality in a medical imaging department and the current study also intended to suggest a framework that could be used to improve quality in medical imaging departments.

3.2 THE ROLE OF RADIOGRAPHY IN A CLINICAL COMPONENT

Radiography is responsible for the majority of man-made radiation (Balogh, Miller, and Ball 2015: 55). It is, therefore, quite critical that its role in the patient management chain be clearly understood. Radiography is responsible to inform the disease process as early as possible during the diagnostic stage of the patient and unlike other diagnostic tools, it should be accompanied by an interpretation which is dependent on the skill of the radiologist (Larson and Langlotz 2017: 992). There are many other factors on which the interpretation depends including the quality of the image itself. In a clinical setting the process of patient management can be divided into diagnosis and treatment (Pauker and Kassirer 1980: 1114). The diagnostic procedures assist the doctors in understanding the reasons for signs and symptoms experienced by the patient and further helps in providing the doctors to select the best treatment for the disease. The diagnostic process may reveal the type, the size, the extent and other features of a disease (Larson and Langlotz 2017: 993) and as a result the quality and promptness of the diagnostic information is critical.

Diagnostic radiography is the essential part of information gathering that precedes treatment of the patient. When a radiography request is completed, the imaging department is requested to answer a clinical question in the mind of a team of doctors managing the patient. In other words, the clinical team needs to rule out a clinical condition or confirm that the patient is suffering from a particular disease or combination of diseases (Kassirer and Gorry 1978: 251). The appropriateness of an imaging process may be affected by various factors including the availability of imaging modalities, and this is usually determined by the clinical team although this would be based on the report provided by the radiologist's report. Another important aspect of patient management is selection of an adequate modality by the clinical team (Larson and Langlotz 2017: 994). The radiography team has a responsibility to interrogate the adequacy of the requested modality considering the information provided in the request form. On the other hand, the radiology team should be able to advise on the best modality and protocols necessary for diagnosis of the suspected disease. This should be done in communication with the radiologist (where possible) and the requesting doctor. This is particularly important as the radiographer dispenses ionising radiation to the patient. The skills, knowledge, attitude and experience of the radiographer and or/ radiologist are crucial when providing such advices. The involvement of the patient in deciding on the appropriateness of the imaging modality is important as the radiology team might want to ask the relevant questions not appearing on the request form (Larson and Langlotz 2017: 994). The communication between the patient and a member of the radiology team thus becomes important in ensuring that the information provided by the patient is adequate and accurately understood by members of the imaging team.

3.3 QUALITY IN DIAGNOSTIC RADIOLOGY

Whilst it is generally acknowledged that diagnostic radiology represents the largest source of radiation to which the population is exposed, diagnostic radiology continues to fall short of minimising radiation. The main reasons for this are lack

of adequate quality procedures and expert medical professionals that are able to ensure its effective and proficient use (Delis *et al.* 2017: 105). Over years the radiology equipment has technologically advanced in line with complexity of disease trends and the needs of the patients. This has resulted in a steep rise of radiation dose to patients thus calling for major transformation of the quality processes in radiology. The QC that has been known for years has now been replaced by a more inclusive quality system (International Atomic Energy Agency 2013; American Association of Physicists in Medicine 1994). In low- and middle-income countries like South Africa, QC of equipment is often neglected and in some hospitals assessment of equipment quality is only conducted when preparing for inspections for licencing purposes. In South Africa, the quality of equipment is regulated through the SAHPRA Board of the National Department of Health. This board specifies tests to be undertaken on a regular basis. The SAHPRA Board has powers to close radiology departments who do not conform to the set standards in terms of equipment QC. The affected department is usually banned from using the equipment until the necessary tests have been performed.

The International Atomic Energy Agency (IAEA) has been engaged with its member states to move the quality agenda beyond the traditional QC. The intention is to adopt a more comprehensive quality perspective (Delis *et al.* 2017: 105). Furthermore. The International Standards Organisation (ISO) (2015) defines quality as “*degree to which a set of inherent characteristics of an object (product, service, process, system) fulfils requirements (need or expectation that is stated, generally implied or obligatory)*”. Further to this, the World Health Organisation (WHO) stipulates attributes of quality to be effective, efficient, accessible, equitable, safe and patient centred (WHO 2006: 6). The various levels to be included in a comprehensive quality system are QC, QA and Quality Management.

3.3.1 Quality Control

Jones *et al.* (2015: 6660) define QC in diagnostic medical imaging as a continuous process frequently evaluating medical imaging equipment. The main objective of QC is to ensure that a service fulfils the established quality requirements (ISO 2015: 14). It is therefore a tool to compare performance against set standards. It must always be remembered that quantifying performance is only a component of the larger QC process. In South Africa, the statutory SAHPRA Board performs evaluations to ensure that QC tests are completed by all imaging departments. The challenge with this process is that in some institutions these are left until the SAHPRA Board visits such institutions.

3.3.2 Quality Assurance

QA is a process of preventing inaccuracies that may negatively affect quality of care (Delis *et al.* 2017: 106). In diagnostic radiography, the QA activities include the QC procedures. In diagnostic radiography, QA includes aspects of imaging technology such as the imaging room and the design of workflow, selection and purchasing of equipment, installation of equipment, acceptance testing, equipment commissioning, QC, maintenance and support of equipment and disposal of redundant equipment (Delis *et al.* 2017: 106).

3.3.3 Quality Management

ISO 9000 defines quality management as the overall umbrella for all quality concepts including all activities used by organisations to direct, control and coordinate quality. Quality management should include establishing quality policies and objectives. The International Organisation for Standardisation (2015: 14) states that the seven quality management principles are improvement, patient focus, leadership, people engagement, process approach, evidence-based decisions and management of relationships. Ideally in each imaging department an individual should be trusted with the task of ensuring that these principles are in place. The recent adoption of the NCS in South Africa seeks to satisfy the task

of ensuring these quality management principles. The current study explored and investigated quality factors within the eThekweni District and proposed a framework that can be used to enhance quality in imaging departments in this part of the continent.

The major indicators of quality in medical imaging are:

- Radiographic image quality.
- Accuracy of image reporting.
- Turn-around times for imaging reporting.
- Image reject analysis.
- Radiation exposures.
- Usage of contrast media and other drugs.
- Waiting times.
- Adverse reactions and complications arising from procedures.

3.4 MONITORING QUALITY IN IMAGING DEPARTMENTS

There is a need for imaging departments to put systems in place to measure the level of quality rendered (Delis *et al.* 2017: 106). Measuring quality must be conducted against a set of agreed standards. The NCS are used in South Africa to measure and evaluate provision of quality healthcare. The important aspects when monitoring quality in diagnostic radiography are documentation, performance indicators and dosimetry which are explained briefly below.

3.4.1 Documentation

For any quality system, a manual plays a very important role although the documentation process itself is time consuming. The manual can be used by staff in the department as a resource for standards and policies intended to enhance quality in various aspects of the department. Most of the content for such a manual should be similar for radiography departments in public regional hospitals within a

district. It is envisaged that the framework developed through the current study will be a guiding document in further developing such a manual. The manual can also be used as evidence of compliance with quality requirements. To ensure that the manual is effective, it must be updated by all stakeholders in the team (Delis *et al.* 2017: 106).

The main aspects to be included in the manual, as developed by some members of the IAEA, are leadership and strategy (mission and vision, demographics of the population served, organisation of the department, strategic planning and action planning); resources (human resources and qualifications, infrastructure in terms of rooms and facilities, imaging equipment, IT systems and infrastructure, additional equipment and financial resources); radiation safety (radiation safety committee, radiation safety rules and radiation safety manual); quality (QA and QC, QA Committee, plans, actions and records of continuous improvement, incident reporting and documentation control) and clinical guidelines (Delis *et al.* 2017: 105).

3.4.2 Performance indicators

The popular quotation by James Harrington (a quality pioneer) is very important when quality is to be improved. The quote reads: *“Measurement is the first step that leads to control and eventually to improvement, if you can’t measure something, you can’t understand it. If you can’t understand it, you can’t control it. If you can’t control it, you can’t improve it”* (Delis *et al.* 2017: 106). Any quality system must possess clearly distinct indicators so that it would be easy for it to be measured. Departments should identify the bottlenecks that challenge quality and include them in the strategy to improve quality of care.

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- Number of equipment under regular QC programme with established procedures.
- Number of examinations with local doses.
- Number of hours of training per staff member per annum.
- Number of standardised radiological procedures with established examination protocols.
- Turnaround times for different examinations and patients.

3.4.3 Dosimetry

Radiation dose is the unwanted product in the process of image production (Delis *et al.* 2017: 107). The radiation dose should be minimised whilst ensuring that the image quality is not compromised (Carlton and Adler 2013: 141). In diagnostic radiography, dosimetry is used to measure equipment performance, developing guidance levels

like Dose Relative Levels and measuring patient specific dosimetry. Dosimetry can therefore be used to check performance against the standards. In addition diagnostic reference levels can be used to identify the hospital within the district with too high or too low radiation doses (Vassileva and Rehani 2015: W2). Diagnostic reference level were however not determined in the current study.

3.4.4 Clinical audits

The IAEA prescribes that the audit panel consists of people with expertise and experience in all aspects and modalities in the radiography departments. Luengo-Fernandez, Leal, Gray and Sullivan (2013: 1170) defines clinical audit as *“a systematic review of medical radiological procedures which seek to improve the quality and outcome of patient care through structured review, whereby medical radiological practices, procedures and results are examined against agreed standards for good medical radiological procedures with modification of practices, where appropriate, and the application of new standards, if necessary”*. Clinical audits are a process of intentionally finding faults and the intention is for faults to be corrected (Delis *et al.* 2017: 107). The auditors involved in clinical audits should be independent of the process or procedure to be audited and clinical audits should be an integral part of quality improvement in any facility.

3.5 THE NATIONAL CORE STANDARDS

The NCS have been adopted by the South African Department of Health to improve healthcare services in all health establishments. As explained in the document containing the standards (South Africa 2011: 12) purposes of the NCS are:

- Have the same understanding of what is meant by the quality of care in all healthcare establishments.
- Develop a benchmark against which all establishments can be assessed, gaps identified, and strengths appraised.

- Introduce a national framework for certification of healthcare establishments.

As illustrated in Figure 3.1, the NCS are divided into seven domains and each domain is further broken down into several subdomains. Further to the subdomains, there is a standard measured by certain criteria. The domains are Patient Rights, Patient safety, Clinical Governance, Clinical support services, Public Health, Leadership and cooperative government, Operational Management, Facilities and Infrastructure.

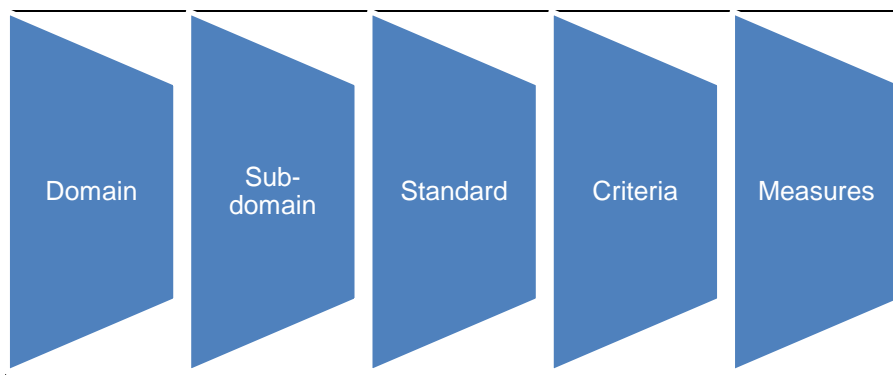


Figure 3.1: Structure of the National Core Standards

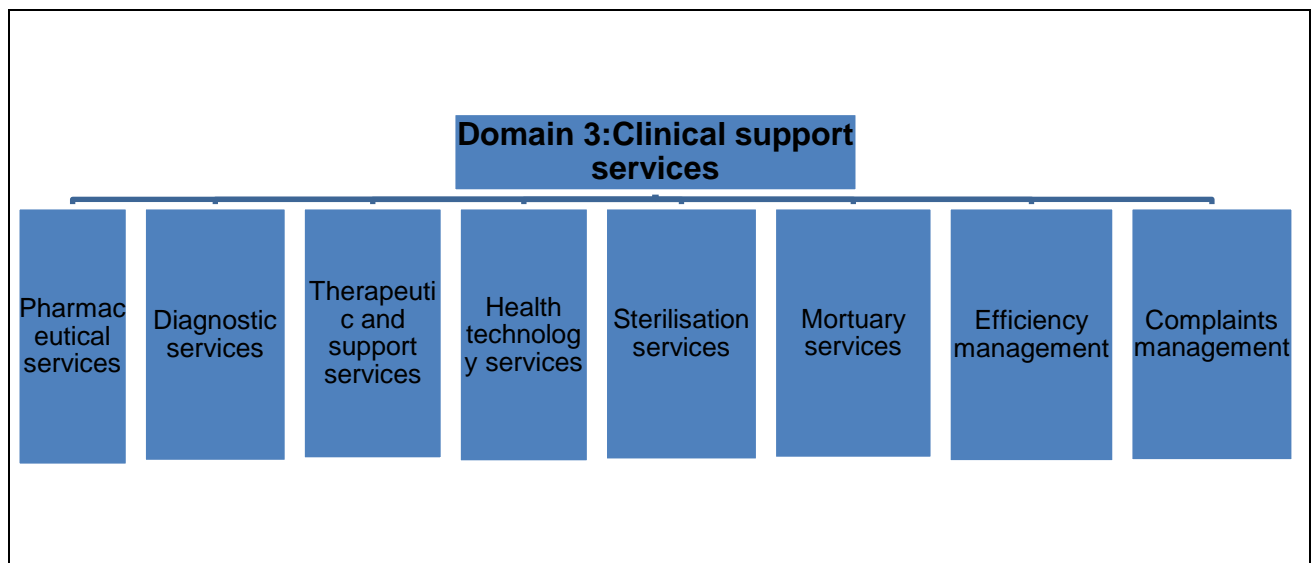


Figure 3.2: Sub-domains for the 'Clinical support services' domain

Figure 3.2 illustrates sub-domains for the third domain of the NCS which is known as Clinical Support services. The sub-domain referred to as diagnostic services is the focus of the current study as the study aims to explore the factors that influence the delays in diagnostic processes when using imaging devices. The standards used to assess this sub-domain are:

- Availability of laboratory services and their ability to provide accurate results within agreed timelines.
- Availability of X-ray services and their ability to provide good quality reports or results within agreed timescales, and protection of staff from unintentional radiation exposure. This is the standard that is the core of the current research particularly the timeous provision of x-ray reports within agreed timeframes.

It should always be remembered that about 20% to 25% of patients in a healthcare establishment are referred to imaging departments for diagnosis purposes (Joshi 2009: 101). In addition, there is a need for policy or some type of guidelines that will ensure that patients are diagnosed within a certain period (Medhi *et al.* 2014: 103). Delays in diagnosis of patients may be due to a number of factors including patients themselves, primary healthcare, and secondary healthcare (Al-Azri 2016: 325). Patient delays are due to patient's ignorance and failure to take actions when disease symptoms begin. In South Africa and many other countries in the world, PHC centres are the first point of contact when signs and symptoms are experienced. Many delays in investigations and diagnosis occur at this level of care. In addition, patients cited a number of factors related to this level of care and these may include non-functional equipment and shortage of resources. Delays also occur at the hospital level.

3.6 SUMMARY OF THE CHAPTER

This chapter has been used to outline the framework used to frame the study. QA and QC are the core components of the study. In addition, the idea of a continuous

quality implementation is embraced. The NCS are also used to guide the current study. The next chapter discusses the research design and methodology.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter describes the research methodology including the design, data collection instruments, research setting, populations and sampling, pre-testing of the data collection tool, data collection process, data storage, data analysis, research trustworthiness, ethical considerations and lastly summary of the chapter. Details on how the researcher intends to approach each of the above sections will be provided in this section of the thesis.

4.2 DESIGN OF THE STUDY

The study design is the process followed by the researcher to reach conclusions about the research question (Hofstee 2013: 108). A non-experimental, cross sectional, mixed methods design was used to conduct the current study. There are a number of mixed methods designs that can be used in research namely explanatory sequential mixed methods, exploratory sequential mixed methods and convergent parallel mixed methods.

The explanatory sequential mixed methods design must be designed such that there are two different phases (Creswell and Clark 2007: 119). In this design, the researcher starts by collecting and analysing the quantitative data. This design is informed by a need to understand the quantitative results and the researcher introduces a second qualitative phase to get explanations on the quantitative results. The other type of a mixed methods design is the exploratory sequential mixed methods design.

The exploratory sequential mixed methods design as described by Creswell and Clark (2017: 122) has two phases like the explanatory sequential mixed methods design but the difference between the two is that when performing the exploratory sequential mixed methods design the researcher starts off by collecting and analysing qualitative data. The researcher then proceeds to the second quantitative phase in which the results of the first qualitative phase are used to design a tool to verify findings of the qualitative phase. The three other types of mixed methods designs that are often used are embedded mixed methods design, the transformative design and the multiphase design.

A convergent parallel mixed methods design was employed to guide the current study. According to Creswell (2014: 36), the convergent parallel mixed methods design as illustrated in Figure 4.1 refers to the equal prioritisation of qualitative and quantitative methods within a single study, whereby qualitative and quantitative strands are implemented concurrently within a single phase of the study. The quantitative and qualitative strands were analysed independently. Following collection and analysis of data in both strands, the two sets of results were mixed to formulate the overall interpretation of the study (Creswell 2014: 36 and Honein-AbouHaidar *et al* 2017: 2). This design was selected to provide a link between the themes regarding provision of quality care by healthcare providers with patient responses to statements regarding their satisfaction.

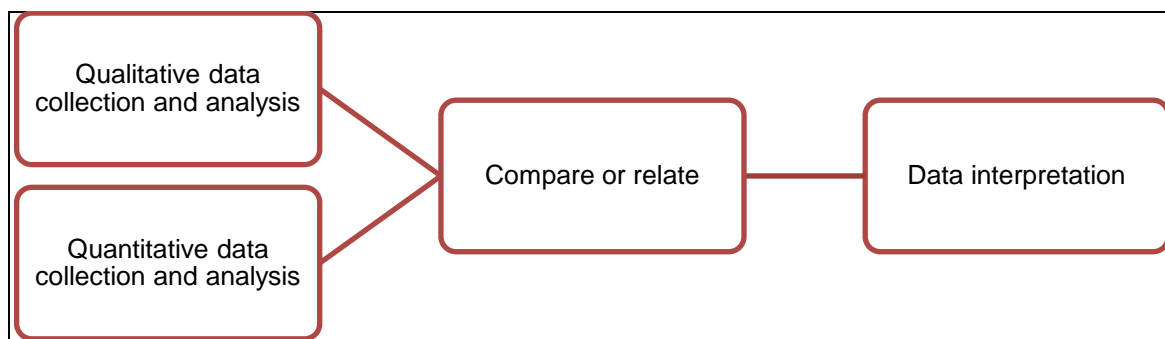


Figure 4.1: Illustration of the convergent parallel mixed methods design (Creswell 2014)

For the current study both the qualitative and quantitative strands were implemented parallel to each other. Each of the objectives was studied as per Table 4.1 below.

Table 4.1: Adequacy of the research methods per objective

Objective	Research question	Data collection method	Data collection approach	Data analysis method
Establish image/film reject rates and reasons attributing to image rejection	What is the image/film rejection rates and the reasons for rejection of images?	Conduct image/film reject analysis.	Quantitative	SPSS
Investigate levels of patient satisfaction in the imaging departments.	To what extent are the patients satisfied with the service delivery in imaging departments?	Patient satisfaction survey.	Quantitative	SPSS: One sample t-test, univariate analysis, Analysis of Variance (ANOVA), Levene's Test for Equality of Variances, Spearman's rho and independent sample t-tests were used.
Assess perceptions of radiographers regarding the tool currently used in licensing inspections.	What are the perceptions of radiographers regarding the tool currently used in licensing inspections?	Interviews with radiographers and Radiography Managers.	Qualitative	Content analysis
Assess the factors affecting quality in imaging departments.	What are the factors that affect quality in imaging departments?	Interviews with radiographers, Radiography Managers, doctors and QA Managers.	Qualitative	Content analysis
Explore quality improvement strategies that can be employed in imaging departments.	How can quality be improved in imaging departments?	Interviews with diagnostic radiographers, Radiography Managers, doctors, and QA Managers.	Qualitative	Content analysis
Develop a framework that can be used to improve quality in the medical imaging departments.	What framework can be used to improve quality services in diagnostic imaging departments?	Analysis of data collected during quantitative and qualitative strands	Convergent parallel mixed methods design	

4.3 PHILOSOPHICAL UNDERPINNING FOR THE CURRENT STUDY

All researchers have a set of beliefs that guide their reasoning and the way they do things (Guba 1990 in Creswell 2014: 35). Other researchers refer to these beliefs as paradigms (Lincoln, Lynham and Guba 2011: 164) whilst others call them epistemologies and ontologies (Crotty 1998: 46). According to Creswell (2014: 35), these sets of beliefs are generally philosophical views about the world that the researcher brings to the study. These influence various aspects about the study including the study methodology selected, the study design as well as how the results will be interpreted. The researcher for the current study believes in numerous solutions to a problem. For this reason pragmatism was used to underpin the current study and this is discussed below.

4.3.1 Paradigm

A paradigm is defined as a common view that symbolises the beliefs and values in a discipline and it also guides methods and strategies used to solve problems (Schwandt 2001: 183). Jonker and Pennink (2010: 25) extend this definition further by explaining a paradigm as a group of basic assumptions and beliefs relating to how the world is perceived. The researchers choose quantitative, qualitative or mixed methods approach based on their beliefs. There are a number of research paradigms and the most commonly used are pragmatism, constructivism, post-positivism and transformative (Creswell 2014: 35). The current study was designed based on pragmatism so as to find answers to the complex questions asked (Botma, Greef, Mulaudzi and Wright 2010: 255). Furthermore, there are common aspects on all four worldviews and each worldview takes a particular stance on each of these aspects (Creswell and Clark 2007: 23). The common aspects are ontology, epistemology, methodology and axiology and are briefly discussed below.

4.3.1.1 Ontology

Ontology explains the nature of reality as known to the researcher (Guba and Lincoln 1994: 105). The researcher aligns himself with pragmatism and thus believes in singular and multiple nature of realities (Creswell and Clark 2011: 42). It is for this reason that a mixed methods design was used in answering the questions raised in this study.

4.3.1.2 Epistemology

Epistemological questions relate to the nature of the relationship between the researcher and that which can be known about a particular concept or area (Guba and Lincoln 1994: 105). A pragmatic approach was adopted whereby the researcher collected data using what works (Creswell and Clark 2011: 42). The researcher is a qualified radiographer with many years of experience in three different aspects of radiography (clinical work, management and academic sphere). There is a strong belief by the researcher that quality of care is extremely important for the smooth running of an imaging department.

4.3.1.3 Methodology

Methodology defines the method in which the study is to be carried out (Creswell and Clark 2011: 42). The researcher used a mixed methods design thus combining qualitative and quantitative approaches. As explained by Morgan (2007: 69), the most suitable methods are used to answer the most appropriate questions.

4.3.1.4 Axiology

Axiology explains the role of values maintained by the researcher during the study (Creswell and Clark 2011: 42). The primary researcher maintained high values during data collection and analysis as he believed in presenting the truth about the research findings. The researcher further embraced the objective and subjective views (Wahyuni 2012: 70) and this helped as he was willing to accept results as they were and report them accordingly.

4.4 PRAGMATISM

Pragmatism, is described by Creswell (2014: 39), as a world view in which the researcher uses many approaches to collect and analyse data. As a result, pragmatism is always used together with mixed methods designs as pragmatists are not committed to any one system of reality and philosophy (Morgan 2007: 48). Individual researchers have a freedom of choice. Pragmatists do not see the world as an absolute unit. In a similar way, mixed methods researchers look at many approaches for collecting and analysing data rather than subscribing to only one way. Pragmatism therefore introduces researchers to multiple methods, different worldviews, assumptions, data collections and analysis. Pragmatists believe that research paradigms can remain separate but may be mixed to form another research paradigm. In the current study both quantitative and qualitative study designs were mixed to gain insight into the research question. Pragmatism was first developed in North America by historical giants of research such as Charles Sanders Peirce, William James and John Dewey. In pragmatism, for an idea to be believed it must be proved to be working. This relates to the nature of pragmatism as the word “pragma” is a Greek word for ‘work’. Pragmatism concentrates on the consequences of research, is centred on a problem, is pluralistic and focuses on what works (Creswell, Klassen, Clark and Smith 2011: 543). The current study thus employed an interpretative framework founded on pragmatism. There is no single viewpoint that can give the full representation of the exploration of the factors affecting quality in diagnostic imaging departments to develop a framework that can be used to improve quality in the imaging departments. Interpretative framework is a complex framework including beliefs, feelings, expectations, goals and knowledge (Creswell 2014: 56).

4.5 SETTING

The study was conducted in regional hospitals in the eThekweni District of KZN Province. The province has a population of more than ten million people and more than a third (3 442 361) of the provincial population resides in the eThekweni District (Statistics South Africa 2016: 10). The eThekweni District is a

Metropolitan Health District with urban, rural and peri-rural areas. The district covers the area between the Umkomaas in the south to Tongaat in the north. It then moves inland to Ndwedwe in the east and ends at Cato Ridge in the west. In addition to being heavily urban and densely populated, pockets of rural communities exist on the outskirts of the west, south and north impacting on access to services and equity.

The healthcare services are rendered by one central/academic hospital, five regional hospitals, two district hospitals, four specialised hospitals, eight community health centres (CHCs) and 110 clinics including 57 clinics under the municipality. The burden of workload on regional hospitals is compounded by the lack of diagnostic imaging services in the 110 clinics as in South African public service the diagnostic imaging services are offered from CHC and higher. Service delivery challenges in the district include inequitable distribution of CHC and primary health care (PHC) services provided by both the municipality and province. Furthermore, the south-central area of the district has only one CHC (Cato Manor) which was not rendering a 24-hour service at the time of this writing. The lack of PHC facilities in the central Durban and surrounding areas has resulted in regional hospitals being the main sources for PHC services. In addition, some of the PHC centres do not offer comprehensive services. Further to this, due to the number and capacity of regional hospitals in the District, they are the main providers of healthcare services in this district. This is the main reason why the study focused on regional hospitals. The regional hospitals in the eThekweni District were allocated codes for the purposes of confidentiality. The hospitals are Hospital A, Hospital B, Hospital C and Hospital D and the hospitals represented by each code were only known to the primary researcher. Radiography departments in all regional hospitals in the district are managed by qualified radiographers who serve as Radiography Managers. In addition to these managers there are other managers with the title of Assistant Director: Radiography who work together with the Radiography Managers in managing the departments. However, there is inconsistency in terms of the number of the managers in each hospital. The responsibilities of these managers differ per

hospital but the overall purpose of managing the departments is similar for all of them.

4.6 POPULATION

According to Polit and Beck (2013: 273), a population in research is the entire group of cases in which the research is to take place. In the study, population referred to various groups in regional hospitals in the eThekweni District. There are five regional hospitals in the eThekweni District and in addition there were a total of 29 422 patients undergoing diagnostic imaging examinations each month. Subsequent to this, patients, diagnostic radiographers, doctors, Radiography Managers and hospital QC Managers, also formed the population in the current study.

4.7 SAMPLING PROCESS

Sampling is defined by Polit and Beck (2012: 339) as the process in which the researcher uses a portion of the population to represent the bigger population in the study. For quantitative studies, the sample has to allow for statistical conclusions, validity as well as generalisability of the results (Polit and Beck 2013: 273). In ensuring these aspects of the study, the researcher ensured that the sample was of the correct size by consulting a statistician. A stratified random sampling strategy was thus used when selecting patients to participate in the quantitative strand. This strategy was used to ensure adequate representation of both genders, all races, and ages (Molenberghs 2010: 44). Furthermore, the sample size was calculated using Cochran's formula and the minimum sample was spread proportionately across the four hospitals (Molenberghs 2010: 47). There were 29 422 patients that underwent diagnostic imaging procedures in regional hospitals within the eThekweni District and a representative sample from each hospital was recruited. The sample size was calculated using alpha of 0.05 and a margin of error equal to 0.05 thus the minimum sample size of 301 patients was required.

To ensure rigour of the research study, 10% was added in case some questions were not answered. The researcher recruited and collected data from 332 patients to ensure that each question was answered by the adequate number of participants as illustrated in Table 4.2.

Table 4.2: Sample calculation of patients per hospital

Hospital	Total number of patients per month	Sample (minimum required) Based on a week	Add 10%
Hospital A	9000	92	101
Hospital B	1926	20	22
Hospital C	8496	87	96
Hospital D	10000	102	113
Totals	29422	301	332

For the qualitative strand of the study, a maximum variation purposive sampling strategy was used in selecting radiographers and doctors (Paton 1990: 172). This sampling strategy was employed to include participants from diverse groups for example doctors practising in as many sections of the hospital as possible. A range of experiences for doctors and radiographers was also an important consideration to enrich the data obtained. The study was conducted in four regional hospitals in the eThekweni District and all Radiography Managers and QC Managers in the regional hospitals were included. The intention of using purposive sampling was to select hospitals and participants that would provide rich information on the issues to be explored (Patton 1990: 169 and Etikan, Musa and Alkassim 2016: 3). Data was collected until data saturation point was reached and to ensure that there was no new data missed, the researcher continued collecting from about two participants in each category beyond the data saturation point.

4.7.1 Inclusion criteria

The following inclusion criteria were drawn to ensure that all participants selected would provide useful data about the study:

- All Regional hospitals in the eThekweni District.
- Diagnostic radiographers employed in imaging departments.
- Doctors employed in regional hospitals in the eThekweni District.
- Radiography Managers and QC Managers in regional hospitals.
- Patients who were 18 years and above that have had x-ray examinations conducted.

4.7.2 Exclusion criteria

To focus data collection and ensure that data was only received from relevant participants the following categories were excluded from participating in the study:

- Patients who were too sick or too old to participate in the study.
- Participants used for pretesting of the study.
- Patients under the age of 18 years.
- Radiographers working in other disciplines of radiography other than Diagnostic Radiography.

4.8 DATA COLLECTION PROCESS

Data collection commenced after receiving approval from the Ethics Committee of the Durban University of Technology (Appendix 1) as well as request from and approval by eThekweni Health District (Appendices 2a and 2b), KZN Department of Health (Appendices 3a and 3b), and Hospital Managers (Appendices 4a, 4b, 4c, 4d, 4e, 4f, 4g, 4h). The process of data collection was conducted using quantitative and qualitative types of data collection concurrent to each other. This was possible as none of the two types of data collection were dependent on the other and as such they were equally important in addressing the research objectives. Once both sets of data were obtained, the researcher reached the point of interface and merged the results from both strands. A research assistant was hired to assist the primary researcher with data collection amongst the non-English speaking isiZulu patients. The primary researcher trained the research assistant on basic hospital protocols prior to data collection. These protocols included requesting permission from the sister

in charge of a hospital unit (ward or outpatients departments before collecting data from the patients, infection control practices and respect for patients and staff. In addition, the research assistant was trained on aspects of ensuring validity of the results. These included ensuring that the research assistant would not influence the participants' responses and that questions were asked as formulated. Furthermore, the questions were to be answered with highest possible accuracy (Molenberghs 2010: 42).

4.8.1 Quantitative data: Patient satisfaction survey and film/image reject analysis

For the patient satisfaction survey patients were recruited by either the primary researcher or the research assistant. A pack comprising the letters of information (Appendices 5a and 5b), consent forms (Appendices 6a and 6b) and the questionnaire (Appendices 7a and 7b) were hand delivered by the researcher and his assistant during pre-arranged times so as to avoid disrupting the work flow and improve the return rate of the questionnaires. In addition, Appendices 5b, 6b and 7b were the isiZulu translations of the letter of information, consent form and the questionnaire respectively. Patients were requested to complete the questionnaire at the respective wards and outpatient departments upon their return from the Diagnostic Imaging department. Patients who underwent specialised examinations requiring sedative agents were asked to participate once such agents have stopped working. Patients who were unable to complete the questionnaire on their own were assisted by the researcher and his assistant. Furthermore, participants were requested to complete an informed consent and submit it with the questionnaire. Completed questionnaires were collected by the investigator and were stored in a locked cabinet.

Collection of data for image reject analysis was conducted whilst the research assistant was assisting patients to complete the satisfaction survey. The primary researcher conducted his work in the same Imaging department that the patient satisfaction survey was administered for availability to assist the research assistant should a need arise. At the time of data collection, the

regional public hospitals in the eThekweni District were still in the transition between using wet (conventional) processing and digital imaging (CR and DR). Hospitals were in various stages of the transition. One had a mixture of CR and automatic processing, and the other two were completely on CR whilst one had transformed totally into DR. For this reason, the researcher evaluated films or images depending on what was used in a particular hospital or section of the department. In departments using CR and DR readily available results generated by the units were made available to the primary researcher by the Radiography Managers. In addition, the primary researcher used a tool similar to that developed by the WHO to review rejected images (Appendix 8) and sorted them according to their reasons for rejection.

4.8.2 Qualitative data

There was a single Radiography Manager and a single Quality Assurance Manager in each regional hospital and prior appointments were made in order to avoid disruptions to their work schedules. In addition to the informed consent, an information letter different to that administered to patients was administered to all participants in the qualitative strand (Appendix 9). In-depth interviews were conducted with radiographers, doctors, Radiography Managers and QA Managers simultaneously using questions in the interview guides for each category of participants as per Appendices 10a, 10b, 10c and 10d respectively. The QA Managers are responsible for ensuring that all departments within the hospital maintain high quality. These cadres were included in the current study to elicit how the quality practices from the Diagnostic Imaging departments was perceived in the hospital at large. The interviews with one group were not dependent on the outcomes of interviews with another group hence interviews were held simultaneously. In addition, interviews with Radiography Managers and Quality Assurance Managers were held in their respective offices. Furthermore, in Diagnostic Imaging departments the RM identified suitable offices to hold interviews whilst most doctors preferred to be interviewed in their consulting rooms. Interviews with radiographers were used to explore their opinions about the NCS and their thoughts on certain aspects of quality within their respective departments. Doctors were interviewed to assess their

perceptions and opinion regarding the quality of care provided by the imaging department to patients. The researcher also elicited from the doctors' methods that can be used to enhance quality in the radiography departments.

Furthermore, interviews were held with QA managers to gather their perceptions regarding the level of quality in the diagnostic imaging departments. All the participants who agreed to take part in the study were requested to sign an informed consent. The informed consent included an explanation of how the interview materials would be handled, issues of confidentiality and the option to withdraw at any stage of the study. In addition, hospitals and participants were coded for anonymity purposes. Once the informed consent was signed, interviews were scheduled for the time convenient to participants and the healthcare service. Twenty to thirty minutes were allocated for each interview.

The researcher began each interview with a general introduction including an explanation of the study purpose and the benefits of the research to the participants and healthcare service at large. The introduction assisted in relaxing participants and explanation of the benefits helped in minimising inaccuracies in the interview data. The interviews were voice -recorded and transcribed verbatim by the researcher following granting of permission by the participants. Furthermore, questions were posed to participants followed by probing where necessary to obtain in-depth information. This provided rich data for interpretation and analysis of the results. Data collection continued to the point of data saturation and further continued with five participants beyond this point. Creswell (2014: 207) explains data saturation as the point at which the data obtained no longer brings new properties or does no longer stimulate new insights.

At the end of the interview session the participants were asked if they were satisfied with how the interview proceeded. The participants were also asked if they had any additional information to share with the researcher. In addition, the interview questions were structured to address the relevant research

questions. To validate the concepts emerging from the data collected, the researcher checked the transcripts and requested the participants to check whether the transcripts were a correct representation of their responses prior to data analysis. This was done on a continuous basis along with data collection.

4.8.3 Development and validation of the proposed practice framework

The practice framework was developed with consideration for the literature review and data obtained during collection of data in both quantitative and qualitative strands of the current study (Frampton et al 2017: 1). Four pillars of the framework were developed and linked to various elements as depicted in Figure 9.1. Furthermore, it is important for the researcher to work collaboratively with clinicians so as to ensure relevance and applicability of the research findings and intervention strategies (Peterson *et al.* 2014: 58). The primary researcher in the current study developed a tool (Appendix 11 for validation of the proposed practice framework by radiographers, doctors, QA managers and Radiography managers. This brief questionnaire was sent to the participants together with the proposed practice framework.

4.9 DATA COLLECTION TOOLS

The data collection tools as used for both quantitative and qualitative strands are described below.

4.9.1 Data collection tools used during quantitative strand

The first two objectives required collection of quantitative data. The measuring tools used to satisfy both the first two objectives were used in previous studies and yielded similar results and thus have a high reliability.

4.9.1.1 The tools used for image reject analysis

The first objective required the researcher to collect data on image reject analysis. Data were retrieved from a reject analysis software system inherent in each CR or DR unit. The system allowed radiographers to state reasons for

rejection. From this input the system calculated the percentage of rejections per body part and furthermore for each projection. Number of images performed and rejected were also provided. In addition, the percentage of rejections resulting from a particular cause of rejection was predetermined in the data provided by each hospital. Data obtained from all three hospitals was added and averaged to establish the average reject rate and reasons for rejection in the three regional hospitals.

4.9.1.2 The tool used to measure levels of patient satisfaction

To satisfy the second objective a patient satisfaction survey was undertaken using a questionnaire. The questionnaire was designed by Gawugah whilst performing patient satisfaction survey in a Diagnostic Imaging department in Ghana. The tool is readily available in the public domain and can be accessed from Sheffield Hallam University Research Archives without the need to request permission. Furthermore, reliability indicates the extent of consistency of the measurements completed (Botma, Greeff, Mulaudzi and Wright 2010: 177). In ensuring high reliability and validity the primary researcher checked each question to ensure that they were aligned to the objectives of the study (Gawugah 2016: 87). Furthermore, the questionnaire was rigorously tested for validity and reliability during its design stage (Gawugah 2016: 88). The original questionnaire had 25 items but it was altered by the primary researcher to include demographic details of participants.

The adapted questionnaire (Appendix 7a) was translated into isiZulu to cater for the isiZulu speaking participants who could not understand English (Appendix 7b). The translation from English into isiZulu was conducted by an individual who was conversant with both languages and further checked by the research supervisor who is also excellent in both languages. The questionnaire consisted of two sections and the demographic data section included items such as age, gender, patient status (in-patient or out-patient), marital status, highest level of education, occupation, type of work (if employed) and type of examination. These demographic details were necessary in order for the researcher to analyse trends amongst participants and consider the reasons

for such trends. In addition, the other section consisted of Likert scale statements.

The Likert scale statements measured satisfaction of participants with certain aspects of the Diagnostic Imaging departments using five points (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = agree and 5 = strongly agree). Satisfaction with 25 items was measured and these included locating the department within the hospital, friendliness of staff, cleanliness of the department, safety, waiting times, privacy, communication, facilities and service delivery.

4.9.2 Data collection tools used during qualitative strand

The three middle objectives in the current study required use of qualitative tools as they involved interviews of participants. The tools used for each objective are explained below:

Objective 3 was to assess perceptions of radiographers regarding the tool currently used in licensing inspections. This objective was satisfied using in-depth interviews with radiographers. The primary researcher designed an interview guide (Appendix 10a). With respect to radiographers, the interview guide was designed to satisfy both Objectives 3 and 4. The guide was separated into two parts and the first part contained the demographic details including identification code for both the radiographer and the hospital, gender, age, years of experience, highest qualification and current position. The second part of the guide contained questions on aspects of quality within the department and issues relating to knowledge and attitudes on the tool currently used for licensing inspections based on the NCS.

Objective 4 was to assess the factors affecting quality in imaging departments whilst objective 5 was to explore quality improvement strategies that can be employed in imaging departments. To fulfil both these objectives, participants were drawn from radiographers, doctors, RM and QA managers. Separate interview guides were designed for each group of participants as some

questions on aspects of quality had to be posed differently according to their role in the healthcare system. Interviews with different categories of healthcare cadres were important as quality aspects are viewed differently by each healthcare provider depending on their role in the system (Muller 2011: 250). Two questions were however common across all four groups. These were the question requesting participants to define quality of Diagnostic Imaging services and methods that can be used to improve quality in the Diagnostic Imaging departments. All interview guides were separated into two parts and the questions on the first section were almost similar for all four groups as per the one for radiographers described above.

For doctors the interview guide included questions on the quality of Diagnostic Imaging services such as availability of reports, delays on performance of images requested from the Diagnostic Imaging department and quality of images. Furthermore, doctors were asked about their clarity regarding protocols to be undertaken when requesting imaging services. Probing questions for this question involved availability and adequacy of request forms. In addition, these participants were requested to list three areas requiring improvement in the Diagnostic Imaging department.

The questions in the interview guide for Radiography Managers included commenting on factors affecting quality including waiting times, communication, reasons for repetition of images, image rejection rates and strategies to reduce it and workload. Furthermore, a question was posed regarding the relevance of the tool currently used for inspections. The interview guide for QA managers consisted of questions such as requesting participants to share their views on the quality of service offered by the Diagnostic Imaging department, the nature of complaints received from clients regarding Diagnostic Imaging department, scores obtained by the Diagnostic Imaging department during licencing inspections, main challenges affecting quality and strategies that can be used to improve the quality.

4.9.3 The tool used for validation of the practice framework

The tool illustrated in Appendix 11 was used for validation of the practice framework. The tool was designed by the primary researcher and elicited data on the:

- Ability of the framework in addressing factors affecting quality of services within the diagnostic imaging departments.
- Inclusiveness of the framework in dealing with factors affecting quality of services within the diagnostic imaging departments.
- Applicability of the framework in diagnostic imaging services within the eThekweni district.

4.10 PRE-TESTING OF THE DATA COLLECTION TOOLS

Pre-testing is a process undertaken after the design of the questionnaire (or interview guide) and its purpose is to perfect the questionnaire (Reynolds, Diamantopoulos and Schlegelmilch 1993: 7). Perfecting of the data collection tools relates to elimination of all factors that may be unclear in the questionnaire including use of language and the relevance of questions. In addition, the data collection tools were tested to identify difficulties in interpretation of questions and measure the length of the questionnaire as well as ensuring a high standard of validity, accuracy, reliability, representativeness, objectivity, and ethical standards that could be inherent in the questionnaire. The data collection tools were tested in one of the hospitals within the eThekweni District. This was done to assess correctness of the language and suitability of the tools in ensuring that all research questions would be answered. Pre-testing was conducted at a district hospital and as such data obtained during pre-testing was not included during data collection phase. Pre-testing is important in ensuring that challenges are identified and addressed prior to the main data collection phase. Other important aspects in conducting pre-testing of data collection tools include ensuring that the data collection methods are adequate in identifying confounding variables that would need to be controlled during the data collection phase (Polit and Beck 2012: 380). Pre-testing was also used to gauge the length of time it would take to complete the data collection tools. One

interview was conducted with a staff member from each of the categories to be included during data collection phase. In addition, about five patients were administered with the patient satisfaction survey questionnaire. All data collection tools were deemed to be correct and no changes were proposed by the participants. The average time for completing a questionnaire was about fifteen minutes and the average for each interview was about twenty minutes.

4.11 DATA ANALYSIS

4.11.1 Analysis of quantitative data

The first two objectives required collection of quantitative data and were analysed as described below.

4.11.1.1 Analysis of data from the image reject analysis

Data were analysed using version 26.0 of the SPSS. Reasons for rejection of images were calculated using descriptive statistics and presented in frequency tables. Microsoft Office Professional Plus 2016 was used to create graphs.

4.11.1.2 Analysis of data from the patient satisfaction survey

This set of data was organised and analysed using Version 26.0 of the SPSS. Data cleaning was performed following data capturing. The purpose of this exercise was to remove human errors from the data. This was conducted by checking captured data against the original data. Values outside the pre-coded range that were known as outliers were easily identified and rectified. Consistency checks were also performed during data cleaning. The researcher used this moment to identify missing data. When this was noted the researcher went back to the original data collection tool and corrected if data was obtained. Services of a statistician were also used where necessary (Appendix 12). Descriptive statistics were used to describe and synthesise data whilst inferential statistics were used to make inferences about the population. Frequencies and percentages were used during analysis of each of the

demographic variables. In addition, the researcher also used one sample t-test to test whether mean scores were significantly different from scalar values.

On the other hand, for the Likert scale statements univariate analysis was performed to establish whether there was significant agreement or disagreement to each of the items. In addition, the one-sample t-test was applied to test the average agreement score against the central score of 3.5. In cases where the average was different from 3.5, an assessment of whether there was significant agreement ($M > 3.5$) or disagreement ($M < 3.5$) was made. Furthermore, Analysis of Variance (ANOVA) test was used for several independent samples to compare two or more groups of cases in one variable. In this regard Levene's Test for Equality of Variances was used to compare variables with significant differences. Deeper analysis of results was conducted by using Spearman's rho tests to measure correlations between demographic variables (for example age) and Likert scale variables. Lastly, independent sample t-tests were conducted to compare two independent groups of cases.

An excel spreadsheet was used to code the data and a list of variables was created. This list was available whenever the researcher was analysing the data so as to ensure that the correct variables are interpreted adequately. Once all the data were captured, the original copies were kept under lock and key in a cabinet and the researcher was the only person with access the cabinet. This ensured compliance with anonymity and confidentiality as promised in the informed consent (Botma, Greef, Mulaudzi and Wright 2010: 147).

The researcher performed exploratory analysis by creating univariate and bivariate frequency tables. This assisted the researcher in becoming more familiar with his data set. These tables also helped in identifying any mistakes and thus allowed for correction thereof. With exploratory data analysis, the researcher was able to see whether data distribution was normal or skewed. In this case the researcher could take decisions regarding whether parametric tests or non-parametric tests could be used and was able to demonstrate the

extent to which data was skewed. Exploratory analysis was also used to assess bias in the data set.

4.11.2 Analysis of qualitative data

The primary researcher adopted an inductive approach for data analysis. This approach seeks to interpret data to address a problem or to resolve questions that were raised at the beginning of a study (Thomas 2003: 2). Furthermore, the inductive approach goes along with interpretivism during data analysis. The researcher engaged in the process of preparing data for its analysis, deeply understanding data and interpreted it (Creswell 2009: 183). Content analysis was used whereby qualitative data was transcribed from voice recorder into a word written format (Appendix 13). Data analysis in this strand was conducted using interpretive analysis as explained by Terre Blanche, Durrheim and Kelly (2006: 324) in Botma, Greef, Mulaudzi and Wright (2010: 226). When using this type of analysis, it is important to remember data and have empathetic understanding when analysing it by imagining yourself in the shoes of those affected. During the analysis the researcher continuously moved between known and unknown aspects of data, described and interpreted data. The researcher also considered the minor aspects of data and compared them to the bigger aspect. The five steps used in the current study as described by Terre Blanche, Durrheim and Kelly (2006: 324) in Botma, Greef, Mulaudzi and Wright (2010: 226) are as follows:

4.11.2.1 Familiarisation and immersion

The researcher started developing ideas and theories during data collection. At this stage he also familiarised himself with the data. It is at this stage that the researcher started analysing data so as to build some degree of understanding and meaning of the data and ensuring that research questions were adequately answered. This was only possible when the researcher was immersed in the data. The researcher read the data and listened to voice recordings intensely for a number of times so as to understand them.

4.11.2.2 Coding

Coding began when the researcher was grouping words or phrases on the same meaning. Words were used as units of analysis and thus phrases were also included as well as lines, sentences and paragraphs. Coloured marker pens and cut and paste were used to distinguish between codes. The language used in establishing codes was as close as possible to the language of the participants.

4.11.2.3 Developing themes

Themes and subthemes were identified whilst reading the data. A small number of related codes was used to develop a theme. Data were coded and connected to one of the identified themes. The researcher developed an adequate number of themes and subthemes. Themes represented multiple perspectives from the participants and direct quotations were used as evidence to support them (Creswell 2009: 250).

4.11.2.4 Elaboration

During this stage the researcher identified similar sections of the text with the view to combine them and eventually give a new version of the data.

4.11.2.5 Interpretation and checking

At this stage the researcher interpreted the analysed text and wrote his interpretations. In doing this, the researcher based his writing on the structure provided by the themes. The researcher brought meaning to important expressions made by the participants and used direct quotations from the participants. In this way the researcher ensured that his interpretations were not a mere summary of the text (Polit and Beck 2008: 530).

4.12 MERGING QUALITATIVE AND QUANTITATIVE DATA

During analysis and interpretation, the two types of data were converged and mixing ensued. As explained by Creswell and Clark (2011: 79), the researcher identified content areas noted in both qualitative and quantitative data. These

sets of data were then compared and synthesised in the form of a table or discussion. In this matrix the qualitative findings were brought together with quantitative results. The researcher then concluded this section with a brief discussion explaining contradictions, differences and similarities between the two sets of data. Merging of both sets of data is presented in Chapter 7 of the current study.

4.13 RIGOUR IN THE RESEARCH PROCESS

For both strands of data collection, the researcher undertook strategies to ensure that the research was clear of any impurities as explained below. The researcher incorporated validity and reliability from conceptualisation of the study. The researcher continuously checked for areas that could undermine validity and reliability and as such minimised or excluded their influence on the study. To ensure clarity and correctness of writing, the thesis was reviewed by a professional editor (Appendix 14) and three rounds of editing were undertaken.

4.13.1 Validity

Polit and Beck (2013: 175) explain that validity relates to the precision and uniformity of data obtained and this is associated with methods used to measure research variables. As previously alluded to, validity was enhanced by conducting pre-testing in one of the healthcare establishments within the district. Face validity, is described by Polit and Beck (2012: 379), as means to assess whether the research tool measures what it is meant to measure. This was described by Botma, Greeff, Mulaudzi and Wright (2010: 174) as content validity. The questionnaire has been used in a previous study (Gawugah 2016: 320) and has been proved to contain a high level of validity.

4.13.2 Reliability

Reliability indicates the extent of consistency of the measurements completed (Botma, Greeff, Mulaudzi and Wright 2010: 177). The measuring tool that was used in the study yielded similar results when used in different healthcare

establishments. Botma, Greef, Mulaudzi and Wright (2010: 177) further describe reliability as range of random errors in the measuring method used. Reliability was ensured by using equivalence. Equivalence, is described by Burns and Grove (2005: 374), as the process whereby two individuals measure the same attributes and compare the correctness of the information gathered at the end. Furthermore questions were pre-tested to ensure that they could be asked as formulated. In addition, during collection of data from the patient participants the primary researcher and the research assistant ensured that responses from the participants were not influenced and thus the responses were accurate.

4.14 RIGOUR IN QUALITATIVE DATA

Trustworthiness is described as the degree to which others need to take note of the study and the extent to which the findings can be trusted (Botma, Greeff, Mulaudzi and Wright 2010: 232). Due to the subjective nature of qualitative research, the researcher took necessary steps to ensure validity and reliability as explained by Polit and Beck (2012: 174). In ensuring trustworthiness, the researcher followed the model of Lincoln and Guba using their four epistemological standards. These criteria are credibility, dependability, confirmability and transferability.

4.14.1 Credibility

Credibility, is described by Polit and Beck (2012: 175), as the truthfulness of the data as obtained from the participants including the manner in which the researcher interprets the results. Interviews with participants were continued with five participants beyond the data saturation stage. Probing was also used to bring about clarity to unclear responses. All interviews were voice recorded and subsequently transcribed (Appendix 13 contains the example of a transcripts). Notes written by the researcher were used to double check the truthfulness of the data. To ensure confidence in how true the findings were, the voice recorder was played repeatedly to ensure that all the recorded information was transcribed correctly. Member checks were conducted by

going back to participants to check if all the information was correctly interpreted. The researcher is a radiographer with many years of clinical and managerial experience and used his experiences to judge the responses against what is already known, however without influencing the views and opinions presented by the participants. This is recommended by Curry, Nembhard and Bradley (2009: 1448).

4.14.2 Dependability

Dependability is described as the extent to which the researcher explains the degree of replicability of the study under various settings using the same sample and context (Curry, Nembhard and Bradley 2009: 1448). One of the ways in which this was enhanced in the study was that data were collected from a range of participants with different backgrounds and the researcher ensured consistency when posing questions.

4.14.3 Confirmability

According to Polit and Beck (2012: 176), confirmability refers to the extent to which the researcher ensures that the data represents the responses as received from the participants and is free of the researcher's bias. During collection of qualitative data the researcher used direct quotations from the participants to open interpretations to readers. All recorded material from the field work was kept available to allow for an audit trail. As suggested by Cope (2014: 89), after transcription of voice recorded notes, participants were provided with transcribed material to check if the notes truly represented their responses. Any discrepancies observed during data collection that had the potential to compromise confirmability were investigated and lead to exclusion of a particular set of materials from data analysis. Furthermore, the research assistant was trained to ensure that questions were read directly from the questionnaire and that the responses from the participants were not influenced.

4.14.4 Transferability

Malterud (2001: 485) describes transferability as a level to which the research protocols can be generalised to other settings, contexts or populations. Details of the setting, context and the population were provided to allow for future researchers to be able to replicate the study.

4.14.5 Authenticity

Polit and Beck (2012: 176) describe authenticity as the extent to which the researcher reveals the emotions and feelings of the participants when reporting on their findings. In the study these were revealed by using quotations to express feelings and emotions of the participants. In this study, those reading the report will have a clear sense of the experiences lived by the participants as direct quotations were used to support the findings.

4.15 ETHICAL CONSIDERATIONS

The Institutional Research and Ethics Committee (IREC) of the Durban University of Technology (DUT) reviewed the proposal to considered ethical issues. This committee is accredited and provided permission to conduct the study upon satisfying itself that all ethical issues have been considered. It is the responsibility of every researcher to ensure that all aspects of the research are conducted ethically. The researcher ensured that the rights of all participants were protected. Furthermore, the researcher received ethics clearance from the IREC prior to continuing with the research (IREC 118/19) as per Appendix 1. In addition, the researcher also requested and received permission (Appendices 2a, 3a, 4a, 4c, 4e and 4g) to conduct the study from the eThekweni District (Appendix 2b), KZN Department of Health (Appendix 3b) and the selected hospitals (Appendices 4b, 4d, 4f and 4h).

Ethical issues such as informed consent, anonymity and confidentiality, beneficence and non-maleficence, justice and respect were applied as discussed below.

4.15.1 Informed consent

For the study an informed consent was necessary for both strands as Polit and Beck (2008: 147) suggest that a researcher should obtain informed consent from the participants prior to conducting the research. The researcher provided letters of information to both interview participants and survey participants (Appendices 5a, 5b and 5c) and those wishing to participate in the study were requested to sign an informed consent. It was made clear to the participants that participation was voluntary and that they would be able to withdraw from participation at any stage of the research. Participants were also informed that anonymity and confidentiality would be maintained. In addition, it was mentioned that the data collection tools would not be used to trace back any statements mentioned by researchers during data collection and that information obtained from the study would be destroyed after two years.

4.15.2 Anonymity and confidentiality

Confidentiality relates to the responsibility of the researcher to keep to himself all information received during data collection (Creswell 2014: 63). In order to maintain confidentiality, the researcher kept collected data under lock and key and was the only person with access to the locked cabinet. The spreadsheets used to collect quantitative data were kept in the researcher's computer and the computer is password protected whilst the spreadsheet itself is also password protected. The questionnaire did not require identifying information from the participants and this was explained to the participants as well. Instead, participants were allocated a number to identify a category in which they fall. All interviews were conducted in a private space with only the researcher, the interpreter and participants. All data sheets and audio recordings were moved safely to a safe storage place as explained above and were only removed from the cabinet when the researcher wanted to use them.

4.15.3 Beneficence and non-maleficence

The term beneficence describes the fundamental rights of people to be free from harm whilst non-maleficence means that individuals must be protected

from harm (Polit and Beck 2012: 36). According to Botma, Greeff, Mulaudzi and Wright (2015: 20), the principle of beneficence means that the ratio between risk and benefits must be such that the benefits outweigh the risks. In true sense the word “benefits” in the research context actually means the benefits that might hopefully be obtained from the research study. In keeping with this principle, the researcher took all reasonable steps to ensure that the physical, psychological, spiritual, emotional, legal and social wellbeing of participants were maintained. In addition, data collection and analysis methods were discussed with the participants in detail. Participants were given an opportunity to ask any questions that they had about the study before participating in the study. Participants were affirmed that they may opt to withdraw from the study at any stage without any judgement or prejudice arising from such a decision.

4.15.4 Justice

Justice is described as the principle governing a fair selection and treatment of participants (Polit and Beck 2012: 36). Criteria that ensured best achievement of the research objectives were used to include participants in the study. As a result, personal preferences of the researcher were not used when recruiting participants into the study.

4.15.5 Respect

Self-determination of all participants was protected by ensuring that their respect was maintained. Participants were informed that they have a right not to participate in study. One of the values for the research was respect and all participants were respected during all interactions between the researcher and participants. There were no benefits promised to participants relating to participation in the study.

4.16 CHAPTER SUMMARY

The methodology described in this section of the study is a mixed methods and is suitable to answer the research questions for the study. Sampling strategies

were such that the research was generalisable whilst the qualitative strand made it possible to obtain rich data on quality in imaging departments. Steps were taken to ensure the research rigour for both quantitative and qualitative strands. Steps were taken by the researcher to take care of ethical considerations during all interactions with participants. The next chapter describes how the data from both strands were analysed.

CHAPTER 5: PRESENTATION OF RESULTS: QUANTITATIVE DATA

5.1 INTRODUCTION

The methodology used in this study was discussed in Chapter 4 and in this chapter the quantitative data is presented. The quantitative data were intended to satisfy objectives one and two as illustrated in Table 4.1 in Chapter 4. The objectives achieved through the use of quantitative data collection involved a patient satisfaction survey and analysis of the rejection of images or films. Data collected for the satisfaction of these objectives is represented below. The four regional hospitals in which data were collected were coded as Hospital A, Hospital B, Hospital C and Hospital D. Data on reject analysis could not be obtained in Hospital C as the hospital was still awaiting a reject analysis software.

5.2 RESULTS FROM A PATIENT SATISFACTION SURVEY

The results from the survey administered to patients were captured and analysed using Version 26.0 of the SPSS. Data were received from four regional hospitals coded as explained in the introduction to this chapter. There were no comparisons conducted between the four hospitals thus data was analysed per the eThekweni District only.

5.3 DEMOGRAPHIC DATA

The number of participants in the patient satisfaction survey from each hospital is illustrated in Figure 5.1. As can be noted, most participants were from Hospital A (n=92) whilst the rest were from Hospital B (n=20). One of the questionnaires was destroyed as the participant only completed the demographic section thus the questionnaire was of no value to the study.

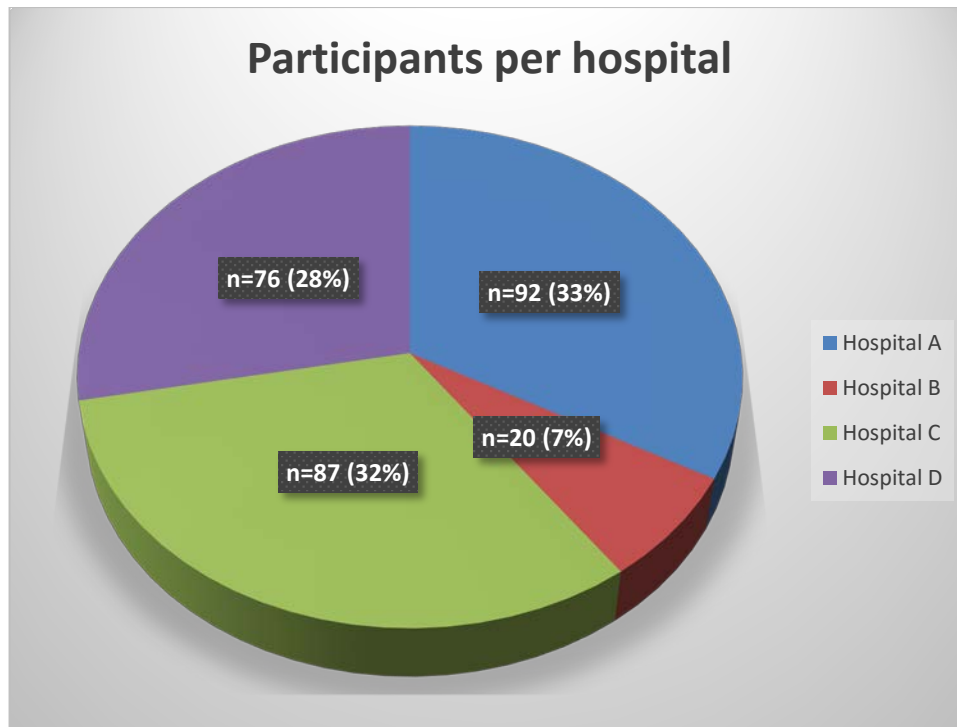


Figure 5.1: Percentage of participants per hospital (n=275)

There were 275 participants who returned their questionnaires following distribution of 332 questionnaires as per the sampling strategy explained in Chapter 4, thus yielding a return rate of 83%. The demographic data for the participants is presented below.

5.3.1 Age and gender

The results revealed that 30.9% (n=85) of the participants were between the ages of 31 and 40 years and 4% (n=11) of the participants were between the ages of 18 to 20 years. The results further revealed that 63.6 % (n=175) of the participants were males. The results are illustrated in Figure 5.2.

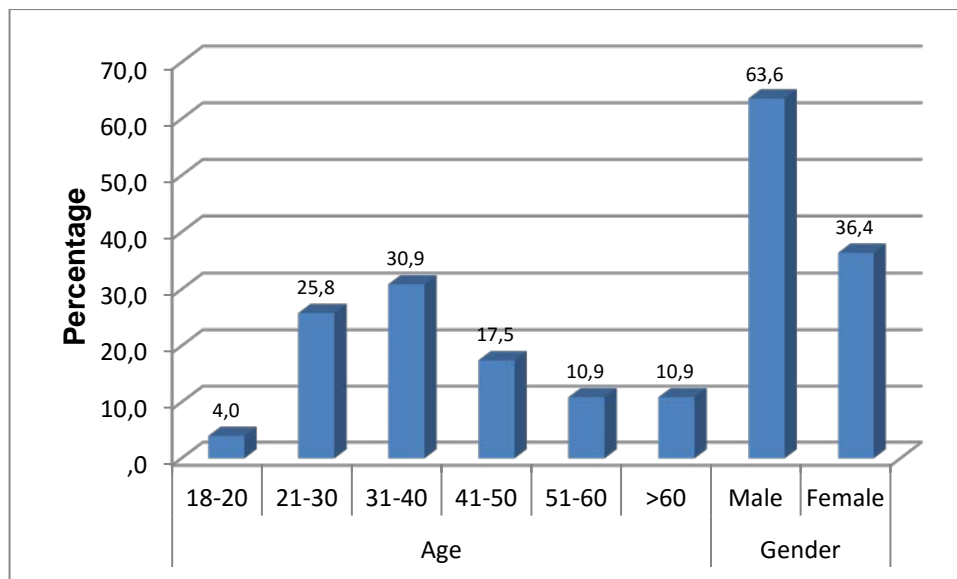


Figure 5.2: Percentage for distribution of age and gender (n=275)

5.3.2 Marital status

The results revealed that 67.6% (n=186) of the participants were single, 25.5% (n=70) were married, 4.4% (n=12) were divorced/separated and 2.5% (n=7) were widowed.

5.3.3 Level of education

The results showed that 67.3% (n=185) had high school education as the highest level of education and only 11.6% (n=32) obtained higher education qualifications. More results are illustrated in Figure 5.3 above.

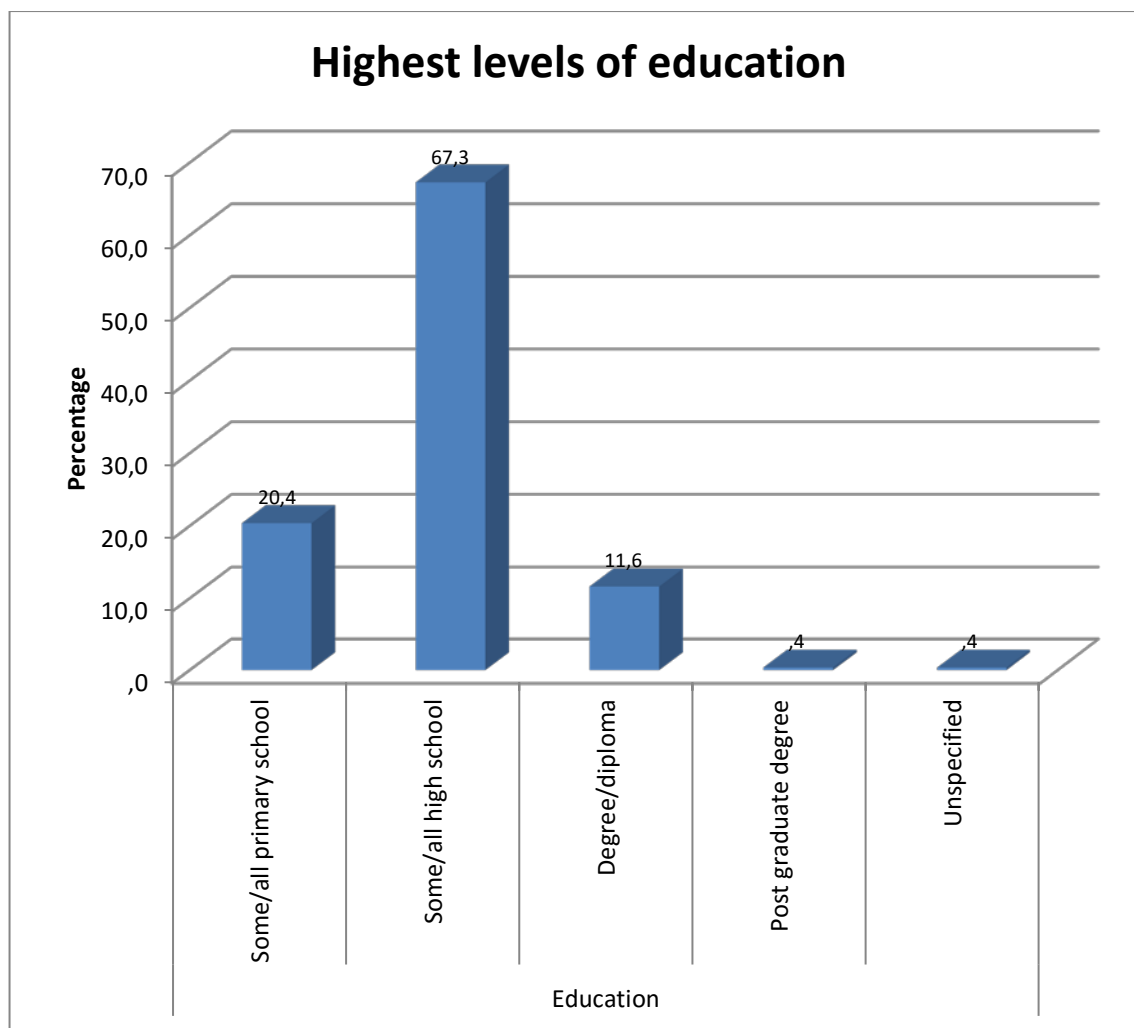


Figure 5.3: Highest levels of education for the participants

5.3.4 Occupational status

The results showed that 41.1% (n=113) of the participants were unemployed and only 27.3 % (n=75) of the participants were employed as per Table 5.1.

Table 5.1: Occupational status of participants

Status	Frequency	Percent
Employed	75	27.3
Unemployed	113	41.0
Self-employed	61	22.2
Retired	26	9.5
Total	275	100.0

5.3.5 Types of work

The results indicated that there were 49.5% (n=136) of the participants with sources of income. These participants were provided with an option to classify their sources of income. The results showed that 36% (n=49) opted not to respond to this statement and thus were excluded from data analysis, 28.7% (n=39) were professionals or had skilled job whilst 27.2% (n=37) were unskilled, 1.5% (n=2) were traders and 2.2% (n=3) were in the security industry and 4.4% (n=6) were clerks or machine operators.

5.3.6 Types of imaging examinations conducted

The results revealed that 97.5% (n=268) of the participants have undergone general radiography examinations prior to them participating in the study, 1% (n=3) had undergone one CT, MRI and biopsy each and 1.5% (n=4) had undergone multiple examinations.

5.4 SATISFACTION OF PATIENTS WITH QUALITY IN THE IMAGING DEPARTMENTS

Univariate analysis was performed for each of the Likert scale statements to establish whether there was significant agreement or disagreement to each of the items. The one-sample t-test was applied for this purpose to test the average agreement score against the central score of 3.5. In cases where the average was different from 3.5, an assessment of whether there was significant agreement ($M > 3.5$) or disagreement ($M < 3.5$) was made.

In summary, the scores of all the other statements except for item number 20 (satisfaction with comfort of waiting area) showed that the average agreement scores were significantly different from 3.5. There was therefore significant disagreement that the participants were satisfied with the overall comfort of the waiting area ($M = 2.6$, $t(275) = -7.915$, $p < .0005$). The summary of all the scores is displayed in Figure 5.4. It is clear that there was a reduction in the level of agreement regarding the length of time spent in the waiting area ($M = 4.35$, $p < .0005$) and the statement on the impact of time spent in the Imaging

Department to personal income ($M = 4.67$, $p < .0005$) among the participants. Further to this, data on each statement is provided below.

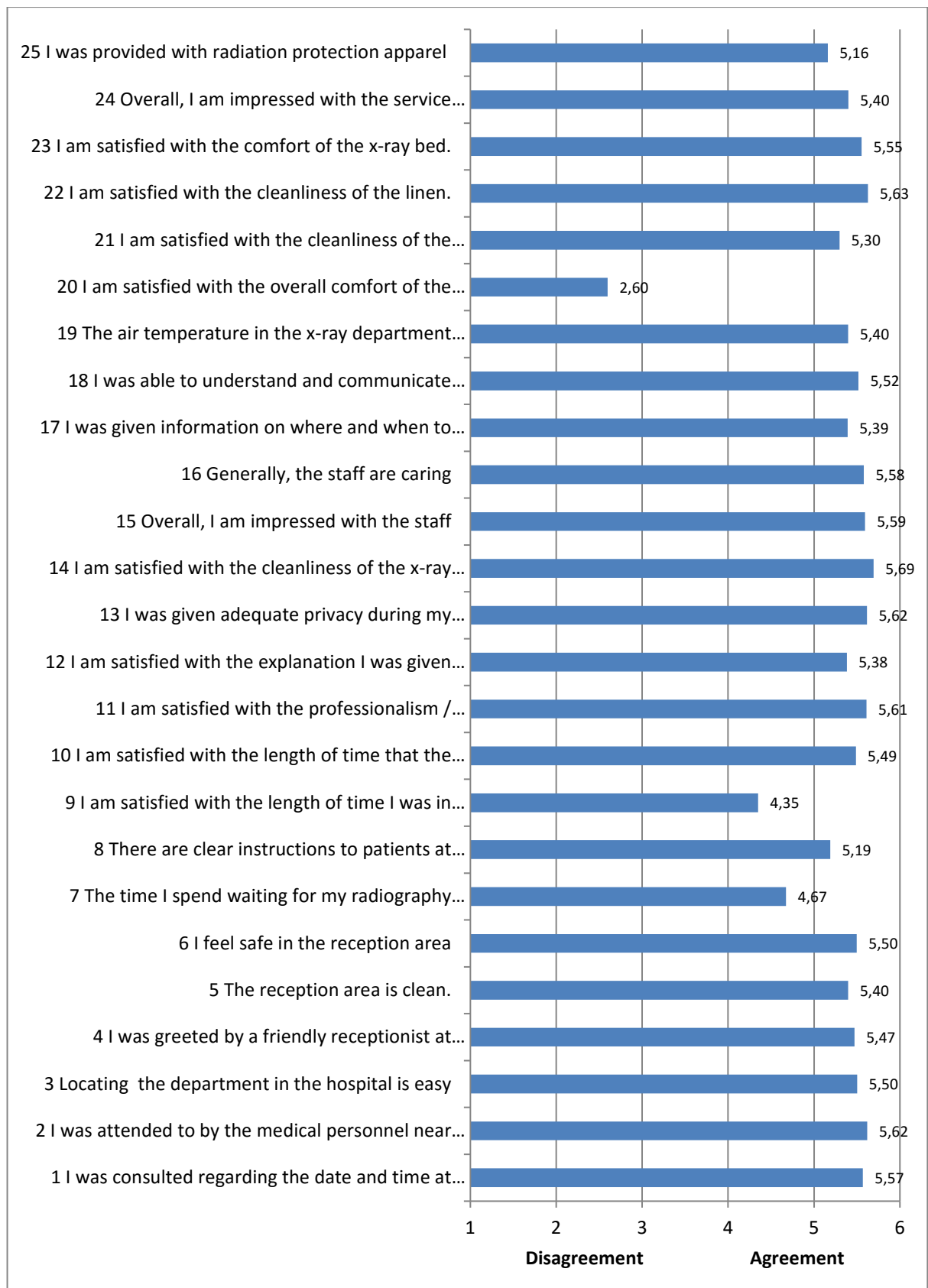


Figure 5.4: Comparison of the agreement/disagreement of scores

5.5 CONSULTATION REGARDING DATE AND TIME OF THE APPOINTMENT

Participants were requested to rate their level of satisfaction with regards to being consulted about the date and time of their appointment. Although the participants responded to this statement, the majority of them had general radiography examinations performed and none of the public hospitals used the appointment system for performance of such radiographic examinations. Results for this statement were disregarded by the researcher as they would add no value to the study.

5.6 WAITING TIMES

Participants rated the length of time they spent waiting to be examined in the Imaging Department. More than 96% ($n = 268$) of them were in agreement that they did not wait for too long ($M = 4.35$, $p < .0005$).

5.7 LOCATING THE DEPARTMENT

As illustrated in Table 5.2, 68.7% ($n=189$) strongly agreed that locating the department in the hospital was easy whilst 0.7% ($n=2$) strongly disagreed with this statement ($M = 5.5$, $p < .0005$). Furthermore agreement was slightly higher for males ($M = 5.60$ in this statement than it was for females. ($M = 5.33$).

Table 5.2: Scores for locating the Imaging Department

Likert scale	Frequency	Percent
Strongly disagree	2	.7
Disagree	9	3.3
Slightly disagree	2	.7
Slightly agree	13	4.7
Agree	58	21.1
Strongly agree	189	68.7
Total responses	273	99.3
Missing System	2	.7
Total	275	100.0

5.8 FRIENDLINESS OF RECEPTIONIST

As can be noted in Figure 5.5, the results of the study revealed that 68.4% (n=188) strongly agreed that the receptionists were friendly as they were greeted with a smile ($M = 5.47$, $p < .0005$).

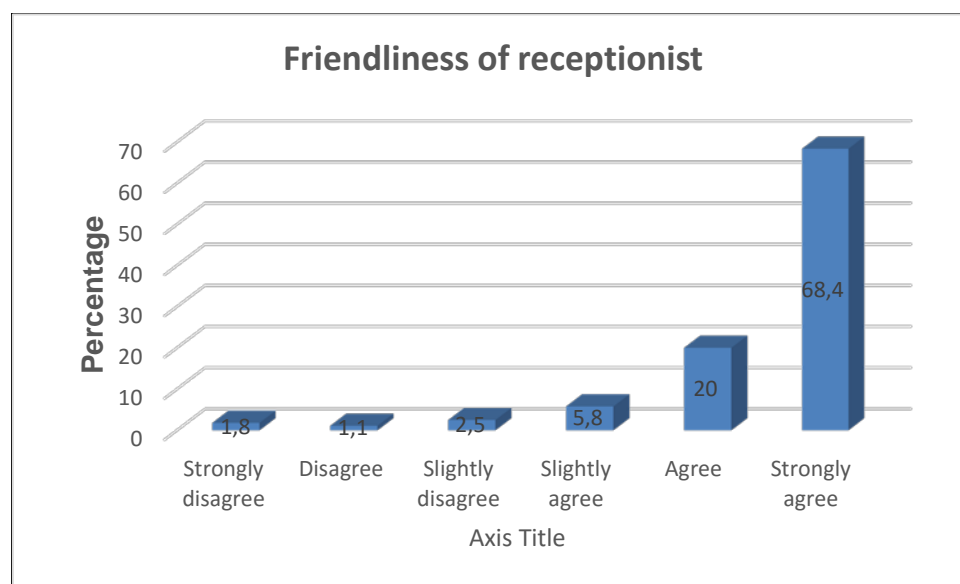


Figure 5.5: Scores for ratings of friendliness of the receptionist

5.9 CLEANLINESS OF THE RECEPTION AREA

The results showed that 65.5% (n=183) of the participants agreed strongly that the reception area was clean whilst 20% (n=55) agreed to the statement ($M = 5.40$, $p < .0005$). In this statement male participants scored a higher agreement level ($M = 5.43$) compared to their female counterparts ($M = 5.34$).

5.10 SAFETY IN THE RECEPTION AREA

There was strong agreement ($M = 5.5$, $p < .0005$) amongst the participants regarding their safety in the reception area. The results further revealed that 94.2% (n=259) agreed with the statement that "*I feel safe in the reception area*" whilst only 5.2% (n=14) disagreed with this statement. As expected, the males felt more safe ($M = 5.51$) compared to females ($M = 5.47$).

5.11 IMPACT OF TIME SPENT IN IMAGING DEPARTMENT ON INCOME

Figure 5.6 is an illustration of the rating for impact of time spent in the Imaging department on income. The results showed that 63.6% (n=175) of the participants agreed that the time spent in an Imaging department or hospital affected their income ($M = 4.67$, $p < .0005$).

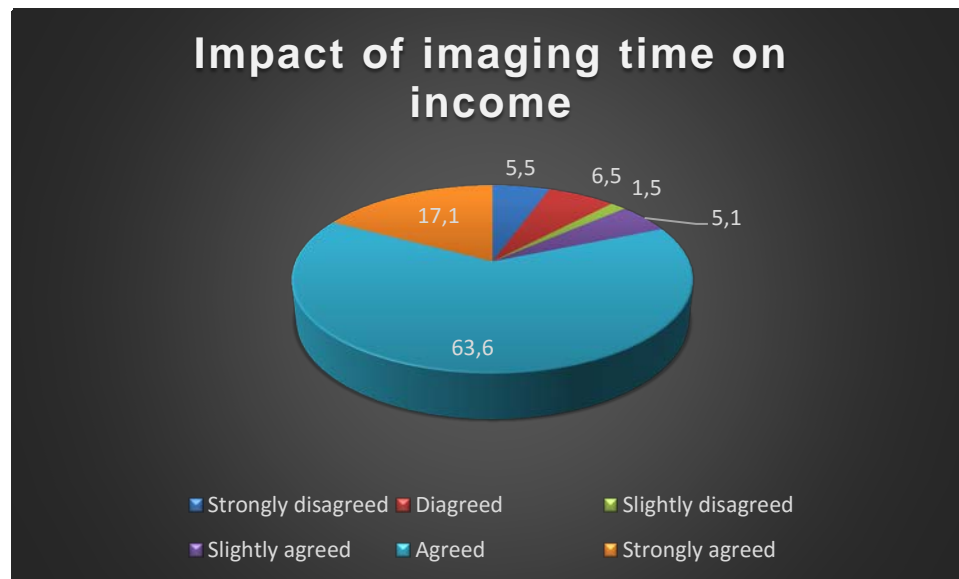


Figure 5.6: Impact of time spent in Imaging Department on income

5.12 CLARITY OF INSTRUCTIONS AT RECEPTION

Participants were requested to rate the clarity of instructions at reception by responding to the statement "*there are clear instructions to patients at reception*" and their responses are recorded in Table 5.3. As can be noted, all the participants responded to this statement and the majority (91%) agreed with it ($M = 5.19$, $p < .0005$).

Table 5.3: Clarity of instructions to participants at reception

Likert scale	Frequency	Percent
Strongly disagree	7	2.5
Disagree	12	4.4
Slightly disagree	6	2.2
Slightly agree	23	8.4
Agree	76	27.6
Strongly agree	151	54.9
Total	275	100.0

5.13 LENGTH OF TIME SPENT AT RECEPTION

Participants were asked to rate their satisfaction with the length of time they spent in the reception area. There was less agreement amongst the participants regarding this statement ($M = 4.35$, $p < .0005$). The results showed that the majority of the participants (71.6%) agreed that they were satisfied with the length of time they spent in the reception area.

5.14 TIME TAKEN TO PERFORM THE EXAMINATION

The results revealed that an overwhelming majority of the participants (94.2%) agreed that they were satisfied with the time taken to perform the examinations/procedures ($M = 5.49$, $p < .0005$). There was less agreement amongst the male participants ($M = 4.63$) when compared to females ($M = 4.75$).

5.15 PROFESSIONALISM/FRIENDLINESS OF RADIOGRAPHERS

There was a strong agreement ($M = 5.61$, $p < .0005$) among participants that radiographers displayed characteristics of professionalism and friendliness. However there was less agreement amongst male participants in this statement ($M = 5.59$) compared to female participants ($M = 5.65$). As depicted in Figure 5.7. The results revealed that the majority of the the participants (97.5%) agreed

with this statement. A Spearman's rho tests proved that there was more agreement associated with older participants ($p < .005$).

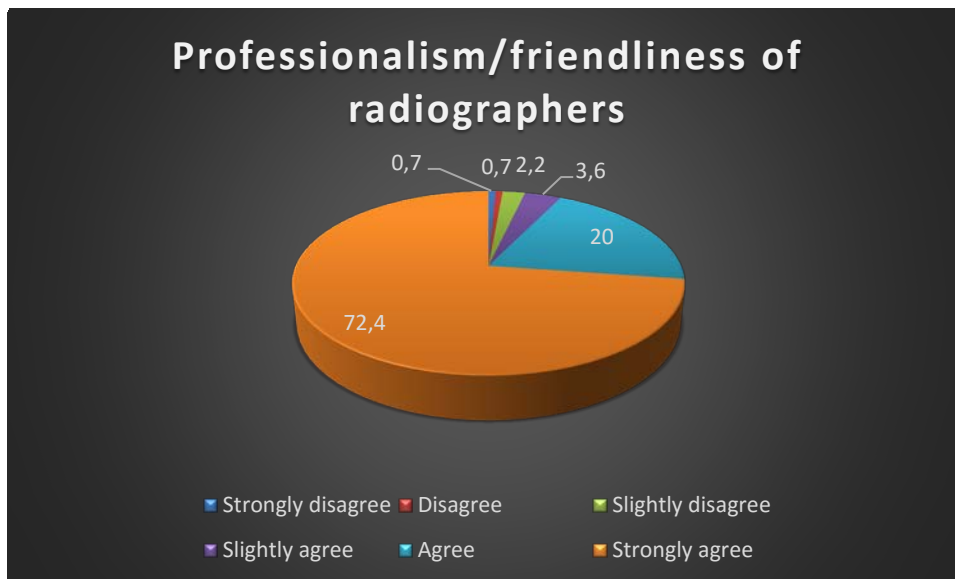


Figure 5.7: Responses regarding professionalism/friendliness of radiographers

5.16 EXPLANATION OF IMAGING EXAMINATIONS

Participants were requested to rate the extent to which the imaging examinations/procedures were explained to them. As illustrated in Figure 5.8, the majority of the participants (92.4%) agreed that examinations/procedures were explained whilst another. Furthermore, there was a high level of agreement amongst participants on this statement ($M = 5.38$, $p < .0005$)

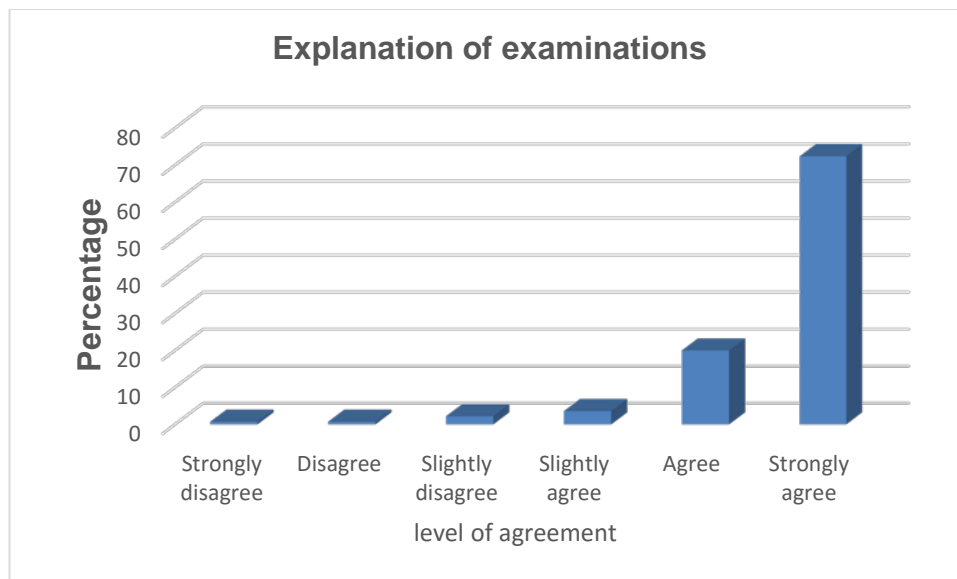


Figure 5.8: Rating of explanation of examinations or procedures

5.17 PROVISION OF PRIVACY

Participants were asked to respond to the statement “*I was given adequate privacy during my procedure*” and the majority of the participants (93.3%, n = 262) agreed with this statement. Furthermore, there was strong agreement amongst the participants (M = 5.62, $p < .0005$). A bivariate analysis showed an insignificant stronger agreement amongst male participants (M = 5.65, $p > .0005$) compared to females (M = 5.56, $p > .0005$).

5.18 CLEANLINESS OF THE IMAGING DEPARTMENT

As shown in Table 5.4, 77.8% (n=214) of the participants were satisfied with the cleanliness of the Imaging departments in regional hospitals within the eThekweni District. There was a strong agreement amongst the participants on this statement (M = 5.69, $p < .0005$).

Table 5.4: Rating of satisfaction with cleanliness of the Imaging Department

Likert scale	Frequency	Percent
Strongly disagree	2	.7
Disagree	2	.7
Slightly disagree	2	.7
Slightly agree	5	1.8
Agree	50	18.2
Strongly agree	214	77.8
Total	275	100.0

5.19 OVERALL IMPRESSION WITH STAFF

The results revealed that 96% (n=264) of the participants agreed with the statement that “*Overall I am impressed with the staff*”. These ratings are illustrated in Figure 5.9. One of the participants did not respond to this statement and as such it was answered by 274 participants. There was a high level of agreement amongst the participants on this statement ($M = 5.59$, $p < .0005$).

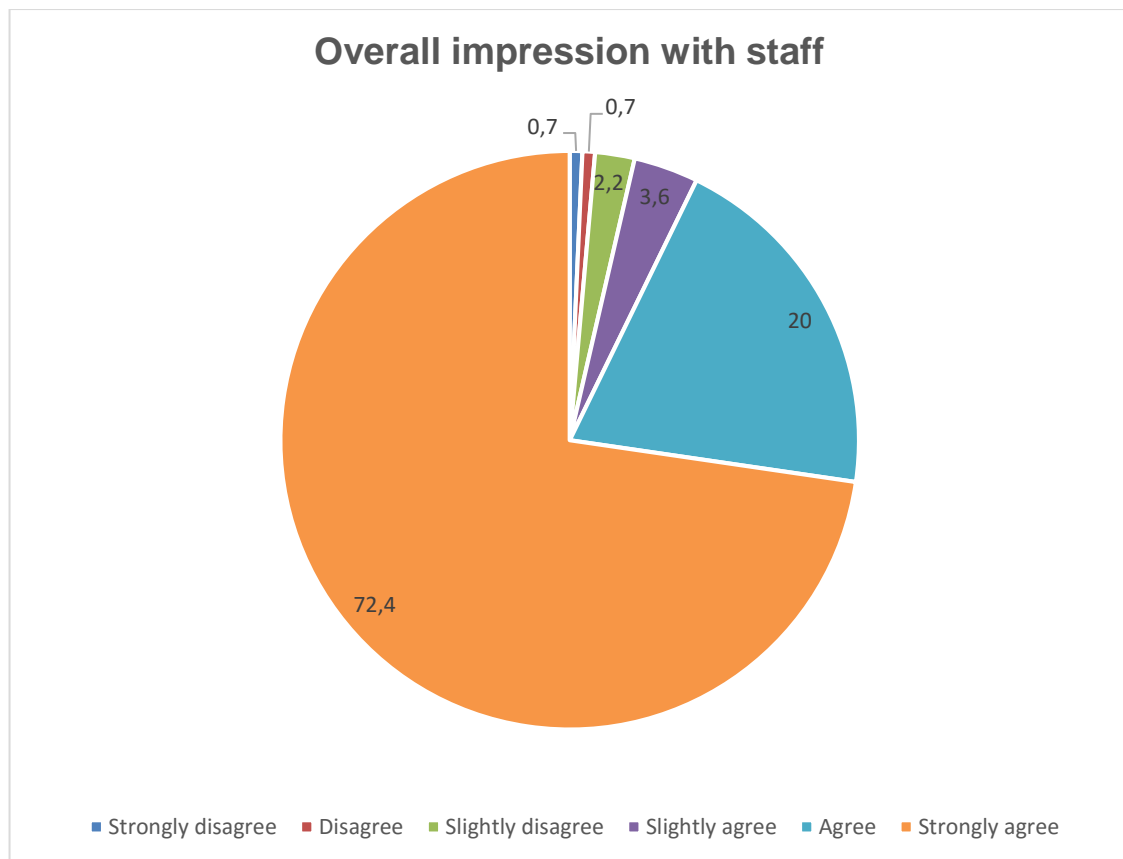


Figure 5.9: Rating of the overall impression of participants with staff

5.20 PATIENT CARE

A total of 274 participants responded to the statement of general care of patients by all staff. The results showed that 96.3% (n=265) of the participants agreed with the statement. In addition, there was a high level of agreement amongst participants on this statement ($M = 5.58$, $p < .0005$). A Spearman's rho test was conducted to correlate this statement with participant's age and it revealed a small positive correlation with age. More agreement on this statement was associated with older patients ($\rho = .133$, $p = .027$).

Table 5.5: Rating on the care of patients by staff

Likert scale	Frequency	Percent
Strongly disagree	2	.7
Disagree	5	1.8
Slightly disagree	2	.7
Slightly agree	11	4.0
Agree	57	20.7
Strongly agree	197	71.6
Total Missing	1	.4
Total responses	274	99.6
Total	275	100

5.21 INFORMATION ON COLLECTION OF RESULTS

The statement on whether participants were given enough information on where and when to collect their results was answered by all the participants and 92.7% (n=255) agreed with it. There was a high level of agreement amongst the participants on this statement ($M = 5.39$, $p < .0005$).

5.22 COMMUNICATION WITH HOSPITAL PERSONNEL

Participants rated their ability to understand and communicate with all hospital personnel and 95.3% (n=262) agreed with this statement. There was a high level of agreement amongst participants on this statement ($M = 5.52$, $p < .0005$).

5.23 COMFORT OF AIR TEMPERATURE

Participants were asked to respond to the statement “*the air temperature in the x-ray department (including waiting room, x-ray rooms and corridors) is comfortable*”. As can be observed in Figure 5.10, 94.2% (n=259) of the participants agreed with this statement. There was a high level of agreement amongst participants on this statement ($M = 5.40$, $p < .0005$).

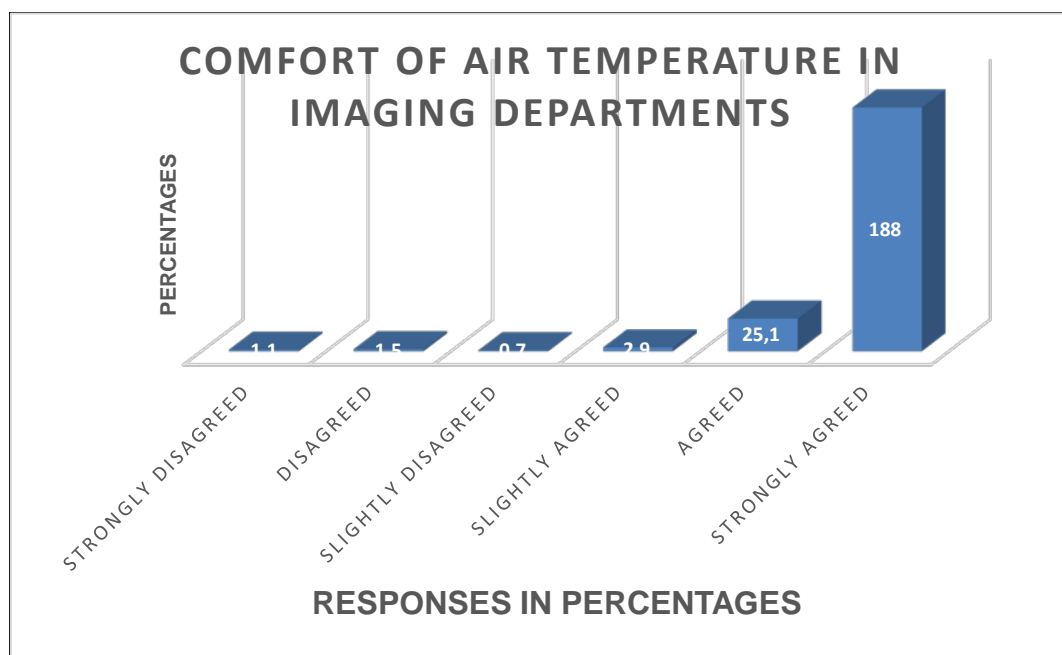


Figure 5.10: Ratings for comfort of air temperature in Imaging department

5.24 OVERALL COMFORT OF THE WAITING AREA

In response to the statement on overall comfort of the waiting area, 65.5% (n=180) of the participants disagreed with the statement. As illustrated in Figure 5.4, the average agreement score for this statement was significantly lower than the central point of the Likert scale ($M = 2.60$, $p < .0005$). More agreement on this statement was associated with older patients ($\rho = .182$, $p = .002$).

5.25 CLEANLINESS OF THE WAITING AREA

Participants were requested to rate the cleanliness of the waiting area by responding to the statement "*I am satisfied with cleanliness of the waiting area*". The results were as illustrated in Table 5.6. The results revealed that 92.7% (n=255) of the participants agreed with this statement. There was a high level of agreement amongst participants on this statement ($M = 5.30$, $p < .0005$).

Table 5.6: Responses to satisfaction with cleanliness of the waiting area

Likert scale	Frequency	Percent
Strongly disagree	8	2.9
Disagree	8	2.9
Slightly disagree	2	.7
Slightly agree	19	6.9
Agree	76	27.6
Strongly agree	160	58.2
Total missing	2	.7
Total responses	273	99.3
Total	275	100.0

5.26 CLEANLINESS OF THE LINEN

The results revealed that 98.1% (n=270) of the participants agreed that they were satisfied with cleanliness of the linen whilst only a mere 1.8% (n=5) disagreed with the statement. In addition there was a high level of agreement amongst the participants ($M = 5.63$, $p < .0005$).

5.27 COMFORT OF THE X-RAY TABLES

The results showed that 96.4% (n=265) of the participants agreed with the statement that *"I am satisfied with the comfort of the x-ray bed"* and another 3.4% (n=9) agreed with this statement and only 1.4% (n=4) disagreeing. The rest of the results are illustrated in Figure 5.11. In addition there was a high level of agreement amongst the participants ($M = 5.55$, $p < .0005$).

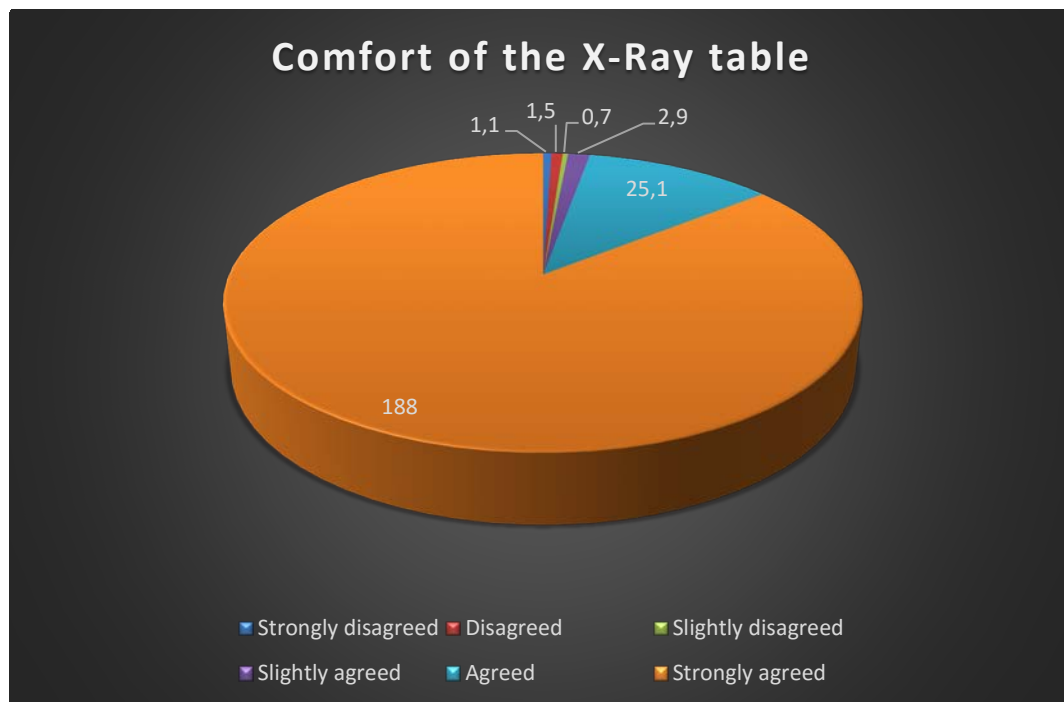


Figure 5.11: Responses to statement on comfort of the x-ray table

5.28 SERVICE DELIVERY

Participants were asked to respond to the statement “*I am impressed with the service delivery in the X-Ray department*”. Their responses are illustrated in Table 5.7 below. As can be noted, 93.8% (n=258) of the participants agreed with this statement. Furthermore, there was a high level of agreement amongst the participants ($M = 5.40$, $p < .0005$). A high agreement on this statement was associated with older patients ($\rho = .182$, $p < .005$).

Table 5.7: Rating of the service delivery in the X-Ray department

Likert scale	Frequency	Percent
Strongly disagree	5	1.8
Disagree	4	1.5
Slightly disagree	7	2.5
Slightly agree	25	9.1
Agree	52	18.9
Strongly agree	181	65.8
Missing System	1	.4
Total responses	274	99.6
Total participants	275	100.0

5.29 PROVISION OF RADIATION PROTECTION APPAREL

Participants were asked to rate the extent to which they were provided with radiation protection apparel and 85.5% (n=235) of them strongly agreed with the statement. There was a high agreement amongst participants in this statement ($M = 5.16$, $p < .005$).

5.30 INFLUENCE OF THE DEMOGRAPHIC STATUS OF PARTICIPANTS ON THEIR SATISFACTION

Bivariate analysis was done to test if the responses to the 25 individual items differed significantly across some of the demographic variables. The analysis was performed for gender and patient status and independent samples t-test was applied as these are both bivariate.

5.30.1 Gender and other variables

As illustrated in Tables 5.8 and 5.9, while both genders of participants agreed on average that they were consulted regarding the scheduling of their appointment, males ($M=5.68$) agree significantly more than females ($M = 5.38$), $t = 2.742$, $p = .007$. In relation to waiting times, both genders of participants

agreed that they were attended to close to their appointment time. It is further clear that males ($M = 5.71$) agreed significantly more than females ($M = 5.46$, $t = 2.502$, $p = .013$). The same is noted for the items “*locating the department in the hospital is easy*” ($M = 5.60$, $t = .042$, $p = .042$).

Table 5. 8: Differences of satisfaction with service delivery according to males and females

	Gender	N	Mean	Std. Deviation	Std. Error Mean
I was consulted regarding the date and time at which my appointment was scheduled.	Male	174	5.68	.812	.062
	Female	100	5.38	.896	.090
I was attended to by the medical personnel near to the time of my scheduled appointment	Male	174	5.71	.728	.055
	Female	100	5.46	.846	.085
Locating the department in the hospital is easy	Male	174	5.60	.866	.066
	Female	99	5.33	1.107	.111
I am satisfied with the overall comfort of the waiting area (e.g. available magazines to read; TV to watch; comfortable chairs).	Male	175	2.34	1.843	.139
	Female	100	3.05	1.904	.190

Table 5.9: ANOVA tests for overall satisfaction with service delivery in four variables

Variables		Levene's Test for Equality of Variances				
		F	Sig	T	df	p
I was consulted regarding the date and time at which my appointment was scheduled.	Equal variances assumed.	4.751	.030	2.817	272	.005
	Equal variances			2.742	190.114	.007
	Not assumed.					
I was attended to by the medical personnel near to the time of my scheduled appointment.	Equal variances assumed.	5.166	.024	2.605	272	.010
	Equal variances			2.502	182.271	.013
	Not assumed.					
Locating the department in the hospital is easy.	Equal variances assumed.	8.689	.003	2.187	271	.030
	Equal variances not assumed.			2.047	166.780	.042
	Equal variances			.754	205.224	.451

	Not assumed.					
I am satisfied with the overall comfort of the waiting area (e.g. available magazines to read; TV to watch; comfortable chairs).	Equal variances assumed.	1.973	.161	-3.049	273	.003
	Equal variances			-3.022	200.708	.003
	Equal variances not assumed.			-1.809	242.669	.072

5.30.2 Age and other variables

A Spearman's rho tests were conducted to identify correlations between age and other variables. As illustrated in Table 5.10, four of these items showed a small positive correlation with age. This meant that more agreement was associated with older respondents. For example, older participants were more satisfied with friendliness/professionalism of staff ($\rho = .174$, $p = .004$), comfort of the waiting area ($\rho = .182$, $p = .002$) and overall service delivery in the Imaging Departments ($\rho = .180$, $p = .003$).

Table 5.10: Correlations between age of participants and other variables

I am satisfied with the professionalism / friendliness of radiographer/ radiologist/ doctor.	Correlation Coefficient	.174
	Sig. (2-tailed)	.004
	N	275
I am satisfied with the overall comfort of the waiting area (e.g. available magazines to read; TV to watch; comfortable chairs).	Correlation Coefficient	.182
	Sig. (2-tailed)	.002
	N	275
Overall, I am impressed with the service delivery in the X-ray department.	Correlation Coefficient	.180
	Sig. (2-tailed)	.003
	N	274

5.30.3 Grouping of variables

The 25 items on the Likert scale section of the questionnaire were grouped into similar items that would yield a single reliable measure for a group. Reliability of such items is evident if the Cronbach's alpha $> .7$. A lower value of alpha is

acceptable if there are only few items in a group. The constructs are illustrated Table 5.11 below.

Table 5. 11: Establishment of constructs

Construct	Items	Label	Cronbach's alpha
Cleanliness	5 The reception area is clean.	CLN	.720
	14 I am satisfied with the cleanliness of the x-ray department.		
	21 I am satisfied with the cleanliness of the waiting area.		
	22 I am satisfied with the cleanliness of the linen.		
Staff	4 I was greeted by a friendly receptionist at reception.	STF	.756
	11 I am satisfied with the professionalism / friendliness of radiographer/ radiologist/ doctor.		
	15 Overall, I am impressed with the staff		
	16 Generally, the staff are caring		
	24 Overall, I am impressed with the service delivery in the X-ray department.		
Comfort	6 I feel safe in the reception area	COMF	.644
	19 The air temperature in the x-ray department (including waiting room, x-ray room and corridor) was comfortable.		
	23 I am satisfied with the comfort of the x-ray bed		
Communication/ directions	3 Locating the department in the hospital is easy	COMM	.672
	8 There are clear instructions to patients (e.g. where to place one's medical cards or folders) at reception		
	12 I am satisfied with the explanation I was given regarding the examination/ procedure I was receiving.		
	17 I was given information on where and when to collect my results.		
	18 I was able to understand and communicate with all hospital personnel (by using an interpreter if necessary).		
Booking schedule	1 I was consulted regarding the date and time at which my appointment was scheduled.	SCHED	.878
	2 I was attended to by the medical personnel near to the time of my scheduled appointment		

Further analysis was done on each composite construct to test for significant agreement and disagreement and to see in what area the hospitals in the eThekweni District performed. Results of this analysis are illustrated in Table 5.12.

Table 5. 12: Analysis among constructs

Constructs	N	Mean	Std. Deviation
Cleanliness	275	5.5052	.70571
Staff	275	5.5324	.65192
Comfort	275	5.4848	.70773
Communication	275	5.3960	.71370
Booking time	275	5.5873	.79896

There is significant agreement that all the areas represented by the constructs in the x-ray department are acceptable to the patients ($M > 3.5$, $SD > .7$).

5.31 REJECT ANALYSIS

Of the three hospitals in which data on reject analysis was collected, two hospitals used a software whilst the other one used the manual process of film reject analysis. The software used allowed for deeper analysis of the rejected images for example determination of the projection of a particular body part that was most rejected.

5.31.1 Image reject analysis rates

Reject rates were determined for the period October to December 2019 as illustrated in Table 5.13. As stated earlier on, the results for reject analysis could not be obtained from Hospital C. In addition, the October results for Hospital B were very high whilst the December results for Hospital D were very low.

Table 5.13: Reject rate per hospital: October to December 2019

Hospital	October	November	December
Hospital A	15%	14%	9%
Hospital B	16%	9%	7%
Hospital C	N/A	N/A	N/A
Hospital D	5.9%	4%	2.1%
Average	12.3%	9%	6%

5.31.2 Reasons for rejection of images

The software system used in Hospital A and in Hospital B is set such that the radiographer has to enter the reason for rejecting each image that is not included in the package of images sent to the requesting healthcare professional. In Hospital D reasons for rejection of images were provided in a manual format. Reasons for rejection of images are presented below.

5.31.2.1 Reasons for rejection in Hospital A

Whilst images rejected for other reasons as illustrated in Table 4.14 were quite low, the images rejected for being blank were unacceptably high. This pushed the total reject rate for the stated period to 13%.

Table 5.14: Reasons for rejection of images in Hospital A during the period October to December 2019

Reason	Number of images rejected	Percentage rejected
Blank	196	85%
Positioning	2	1%
Exposure factors	1	0%
Motion	0	0%
Artefacts	0	0%
Clipped anatomy	7	3%
Duplicate	5	2%
Average	231	13%

5.31.2.2 Reasons for rejection in Hospital B

The results showed that 26% (n=79) in this hospital were rejected due to patient positioning and 4% (n=11) of images were duplicated. As illustrated in Table 5.15 the average reject rate for the period examined was 16% (n=293).

Table 5.15: Reasons for rejection in Hospital B during the period October to December 2019

Reason	Number of images	Percentage rejected
Positioning	79	26%
Exposure factors	56	18%
Motion	52	17%
Artefacts	53	17%
Clipped anatomy	42	14%
Duplicate	11	4%
Total /average	293	16%

5.31.2.3 Reasons for rejection in Hospital D

The results revealed that 67% (n=146) of images in Hospital D were rejected as they were not marked. Blank images constituted 3.9% (n = 46) of the rejected images and the number of images rejected due to other reasons as illustrated in Table 5.16 were also moderately high. This resulted in a very high reject rate of 30% (n=246).

Table 5.16: Reasons for rejection in Hospital D during the period October to December 2019

Reason	Number of films	Percentage
Exposure factors	20	33%
Positioning	34	15%
Blank	46	3.9%
Unmarked	146	67%
Total/average	246	30%

5.31.2.4 Reject analysis per body part

The primary researcher further investigated rejection rates per body part. As illustrated in Table 5.17, in Hospital A there were 1052 chest images (6 %) of chest images produced during the same period rejected in October 2019 whilst 913 (9%) chest images were rejected during November 2019. Forty percent of rib images were rejected in October 2019 and none of the rib images were rejected in November 2019. In brief 6% (n=2094) of images and 10% (n=1851) were rejected during the months of October and November 2019 respectively.

Table 5.17: Reject analysis per body part in Hospital A during the period October and November 2019

Body Part	October		November	
	Number of Exams	% Rejected	Number of Exams	% Rejected
Abdomen	229	11%	129	16%
Ankle	47	0%	14	0%
C Spine	129	6%	116	13%

Cervicothoracic	4	0%	3	33%
Chest	1052	6%	913	9%
Clavicle	6	0%	0	0%
Elbow	26	4%	11	18%
Femur	28	33%	16	13%
Finger	3	0%	1	0%
Foot	91	2%	25	4%
Facial bones	3	0	0	0%
Forearm	10	0%	16	0%
Hand	45	2%	40	3%
Hip	19	26%	27	30%
Humerus	17	12%	10	20%
Knee	3	0%	93	5%
L Spine	197	5%	200	12%
Mandible	11	18%	9	11%
Nasal Bones	0	0%	2	0%
Odontoid	1	0%	6	33%
Pelvis	7	4%	57	16%
Port Abdomen	0	0%	1	0%
Port Chest	0	0%	5	0%
Ribs	5	40%	6	0%
Sacrum	2	0%	1	0%
Scapula	24	18%	6	0%
Shoulder	0	0%	22	0%
Sinuses	20	0%	13	33%
Skull	40	18%	31	17%
T Spine	56	11%	42	0%
Thumb	0	0%	1	0%
Tibia Fibula	34	0%	30	3%
Toes	0	0%	1	0%
Wrist	5	0%	4	0%
Total/average	2094	6%	1851	10%

As illustrated in Table 5.18, a total of 729 chest images were rejected as recorded in one CR unit in Hospital A and 93% (n = 678) of them were blank. In another CR unit in the same hospital 9028 images were rejected for emerging blank and 46.3% (n=4179) of these images were for the chest. Further analysis revealed that 92% (n = 3856) of the chest images were for the PA and AP projections. The rest of the images were for other projections of the chest like the lateral.

Table 5.18: Reasons for rejection of chest images in Hospital A by projection from a single CR machine in September 2019

Reason	Projection	Number of Exams	% Rejects
Blank		678	93%
Test/Service	Lateral	2	0%
	PA	20	3%
Clipped Anatomy	AP	3	0%
	Lateral	1	0%
	PA	12	2%
Positioning Error	AP	1	0%
	Lateral	1	0%
	PA	3	0%
Duplicate	AP	1	0%
	PA	4	1%
Artefact	PA	2	0%
Motion	PA	1	0%
Grand Total		729	100%

In Hospital A during the period January to November 2019, 1395 images were rejected from one CR unit as per Table 5.19 due to them appearing blank. These were for almost all the anatomical structures and projections and 702 (50.2%) were for chest examinations (PA = 408, AP = 202 and Lateral = 53). Forty-six portable images were also found to be blank (Abdomen = 7 and chest = 39).

Table 5.19: Analysis for the rejection of blank images in Hospital A according to body part and projection in January to November 2019

Body Part	Projection	Total
Abdomen	Lateral	15
	AP	104
Ankle	Lateral	4
	AP	17
	Oblique	1
C Spine	AP	22
	Lateral	28
	Oblique	2
Calcaneus	Axial	1
Cervicothoracic	Swimmers	1
Chest	PA	408
	AP	242
	Lateral	53
Clavicle	AP	1
	AP Axial	3

Elbow	AP	14
Facial Bones	Lateral	1
Femur	AP	13
	Lateral	8
Finger	PA	1
Foot	AP	21
	AP Oblique	1
	Internal Rotation	
Forearm	AP	13
Hand	PA	10
Hip	AP	6
	Lateral	5
Humerus	AP	6
Knee	AP	19
	Lateral	17
L Spine	AP	25
	Lateral	28
Mandible	PA	1
Odontoid	AP	2
Other	Other	107
Patella	Sunrise	1
Pelvis	Towne View	13
	AP	9
Portable: Abdomen	AP	7
Portable: Chest	AP	39
Ribs	AP	2
Sacrum	AP	2
Body Part	Projection	Total
Scapula	PA Y View	12
Shoulder	AP	20
Sinuses	PA	9
Skull	AP	5
	Lateral	11
T Spine	AP	7
	Lateral	1
Tibia Fibula	AP	26
	Lateral	26
Wrist	PA	6
	Lateral	1
Total		1395

5.32 CHAPTER SUMMARY

This chapter presented data from the quantitative strand of the study. In this strand data from a patient satisfaction survey were presented. There was acceptable level of agreement among the participants regarding most statements in the Likert scale questionnaire. However, there was significant disagreement regarding the comfort of the waiting area. Tests were also done

to establish correlations between demographic variables and the 25 Likert scale statements and amongst other finding older patients were found to be more impressed with friendliness of radiographers. Five constructs examined in this study were generally found to be acceptable to patients. In addition, data from the image/film reject analysis was presented and reject rates were higher than accepted norms. Reject rates arising from chest examinations were significantly high. Surprisingly there were quite a few images rejected for being blank. The following chapter contains presentation of results for the qualitative strand of the study.

CHAPTER 6: PRESENTATION OF QUALITATIVE RESULTS

6.1 INTRODUCTION

The quantitative data was presented in Chapter 5 and this chapter presents results for qualitative data. The objectives achieved by data collected during the qualitative strand were to assess perceptions of radiographers regarding the tool currently used in licensing inspections; to assess the factors affecting quality in radiography departments and to explore quality improvement strategies that can be employed in imaging departments in regional hospitals within the eThekweni District of KZN. The research questions to be answered during this data collection strand were as follows:

- What are the perceptions of radiographers regarding the tool currently used in licensing inspections?
- What are the factors that affect quality in imaging departments?
- How can quality be improved in imaging departments in regional hospitals within the eThekweni District of KZN?

This chapter only presents data obtained during the qualitative data collection strand and mixing of quantitative and qualitative data will be presented in Chapter 7.

6.2 DESCRIPTION OF THE PARTICIPANTS

Data was collected from 28 participants which included Quality assurance managers (n=3), Radiography Managers (n=3), Doctors (n=9) and Radiographers (n=13). The regional hospitals were coded as Hospital A, Hospital B, Hospital C and Hospital D. In turn participants were also coded according to their role and the hospital in which they were employed for example, Quality Assurance Manager: Hospital A, Radiography Manager: Hospital A, Doctor 1: Hospital A and Radiographer 1: Hospital A. As illustrated in Table 6.1, most participants were from Hospital A.

Table 6.1: Distribution of participants per hospital and category

Category	Hospital A	Hospital B	Hospital C	Hospital D	Total
Quality Assurance Managers	1	1	1	0	3
Radiography Managers	1	1	0	1	3
Doctors	4	1	2	2	9
Radiographers	4	3	3	3	13
Totals	10	6	6	6	28

6.3 DEMOGRAPHIC DETAILS OF THE PARTICIPANTS

As illustrated below in Table 6.2, two of the Quality Assurance Managers were aged between 51 and 69 years and all three of them were females with nursing background. In keeping with their ages, two of them had between 30 and 35 years of experience in nursing and the highest level of education for all three of them was the Bachelor's degree. In terms of the years of experience in their current positions as Quality Assurance Managers, two of them had less than five years of experience whilst one had between five and ten years of experience.

Of the three Radiography Managers interviewed, two were between the ages of 39 and 54 years and the other one above 55 years of age. In addition, two were males and one was a female, and the highest qualification for all of them was the Bachelor of Technology in Radiography. Radiography Managers had between eleven and fifteen years of experience in their roles as Radiography Managers.

Nine doctors participated in the study and six of them were aged 23 and 38 years of age and six of them were females whilst five of them had experience between zero and five. The highest qualification for all of them ($n = 9$) was the MBChB. Two of the doctors specialised in Internal Medicine, one in General Surgery, one in Emergency Medicine and another one in Orthopaedics. Six doctors were Medical Officers, one was a registrar, and another one was a Senior Medical Officer whilst there was also a Specialist surgeon amongst them.

Table 6.2: Demographic data of the interviewed participants

Category		Quality Assurance Managers (n)	Radiography Managers (n)	Doctors (n)	Radiographers (n)
Age	23 - 38	0	0	6	11
	39 - 54	1	2	3	2
	55 - 73	2	1	0	0
Gender	Male	0	2	6	0
	Females	3	1	3	13
Experience in years post qualification	0 - 9	1	0	5	10
	10 - 19	0	1	1	3
	20 - 29	0	1	3	0
	30 - 35	2	1	0	0
Highest qualification	National Diploma	0	0	0	5
	Bachelor's degree	3	3	9	8
Years of experience in current position	0 - 5	2	1	5	7
	6 - 10	1	0	2	4
	11 - 15	0	2	2	2

Eleven of the 13 radiographers who participated in this study were aged between 23 and 38 and all of them were females. Most (n = 10) radiographers were qualified for less than ten years. The highest qualification (n = 8) was the Bachelor of Technology in Radiography and most (n = 7) had experience of less than five years.

6.4 MAJOR THEMES AND SUB-THEMES

There were four themes with a total of 17 subthemes that emerged during analysis of the subscriptions. In turn, a total of 25 categories were identified from the sub-themes. The themes were:

- Defining quality of the imaging services.
- Inadequacy of clinical provisions.
- Leadership and Management.
- Facilities and resources.

The relationships between themes, sub-themes and categories are illustrated in Table 6.3 below.

Table 6.3: Themes, sub-themes and categories from the interviews

Theme	Sub-theme
1. Defining quality of the imaging services.	1.1 Definition by Quality assurance managers. 1.2 Definition by Radiography Managers. 1.3 Definition by doctors. 1.4 Definition by radiographers.
2. Inadequacy of clinical provisions.	2.1 Patient referral protocols. 2.2 Communication. 2.3 Image quality. 2.4 Radiology reports.
3. Leadership and Management.	3.1 Roles and responsibilities. 3.2 Accountability. 3.3 Monitoring of working hours. 3.4 The National Core Standards.
4. Facilities and resources.	4.1 Imaging equipment. 4.2 In-service training. 4.3 Workplace review, planning and development.

During presentation of the results, direct statements from the participants' transcripts are used to substantiate relevance of the statements. The excerpts used were taken directly from the interview transcriptions. The primary researcher took steps to ensure that the excerpts were understandable and logical. For these reasons, minor alterations were done including inclusion/exclusion of punctuations such as full stops, question marks and commas. The coded identification of each participant was inserted at the end of each excerpt. All participants were comfortable in the use of the English and thus all interviews were conducted in English.

6.4.1 Theme 1: Defining quality of the medical imaging services

All the participants were requested to define quality with the view to get a sense of what they their expectations regarding quality of imaging services were. The researcher asked this question prior to asking questions depicting inadequacies and deficiencies related to quality of imaging services.

6.4.1.1 Definition by Quality Assurance Managers

Quality Assurance Managers were requested to define the quality of Imaging services and they expressed concerns for accessibility, availability of porters, absence of complications/reactions, turnaround times/waiting time and image quality. These expressions are illustrated by the excerpts below:

“.....I would say the service is good because it is accessible to people and the number of x-ray facilities are situated in different areas close to the patients and eh.....there are porters for the main x-rays”. (Quality Assurance Manager: Hospital A)

“I expect tests that are ordered done completely without complications or minimum complications if complications are unavoidable. Results should be on time and accurate because you cannot base diagnosis on incorrect results. Pictures that are not clear, and what would you give results for if the patient demised? Everything should be perfect from the procedure to results to reporting for correct diagnosis and treatment”. (Quality Assurance Manager: Hospital B)

“When it comes to quality service in radiology, what is expected is for the patients to be assisted in time. The patient to get the services they requested, for example if the patient went to x-ray, let's say for a chest x-ray, therefore that chest x-ray should be functional. The patient mustn't go to x-ray and then the patient is told “no we are fully booked, please come back after six months”. (Quality Assurance Manager: Hospital C)

6.4.1.2 Definition by Radiography Managers

The Radiography Managers articulated the roles and responsibilities of the Imaging department when they were requested to define in general the quality of imaging services. These included ensuring provision of best services, cleanliness of the department, patient waiting times, patient satisfaction,

performance of quality assurance tests, maintenance of Health and Safety and staff development. These can be noted in the excerpts displayed below:

“Quality is off cause to make sure that the patient gets the best service with resources and services available. Cleanliness, Health and Safety, staff attitude, patient waiting times....”. (Radiography Manager: Hospital A)

“Radiation safety, patient satisfaction, waiting times, radiation quality assurance, and staff development”. (Radiography Manager: Hospital B)

“When looking at equipment, all those things are contributing to the quality of the image. Make sure that quality assurance tests are done, your equipment must be in good working order so you must do your daily tests. In terms of evaluation of the x-rays, our radiographers produce the x-rays but the quality of those images must be checked by someone senior”. (Radiography Manager: Hospital D)

6.4.1.3 Definition by doctors

In their definition of the quality of imaging services, the doctors were mostly concerned with availability of services, waiting times and image quality. This view is illustrated by the following excerpts:

“I would think it (Quality of imaging services) involves getting proper assistance that you need in terms of getting x-ray services. You know proper x-ray parts that we need, proper views and proper quality of these areas. X-rays must be clear because if they are not clear they will not help you with proper diagnosis. And also getting them in time when you need them without any delays”. (Doctor 3: Hospital A)

“Let us start with time, waiting time of the patient. You see now the time is ten, if I send a patient to x-ray now at least by 30 minutes the patient must be back plus minus so that I can make a decision. Secondly the quality of the x-ray, I

should be able to see everything clearly, not the x-ray that is faded". (Doctor 2: Hospital C)

"For me quality means that when you order an x-ray in the ideal situation you must get a good quality x-ray within an hour". (Doctor 1: Hospital D)

6.4.1.4 Definition by radiographers

In their definition of the quality of imaging services, the radiographers expressed most of the statements as mentioned by the doctors, Radiography Managers and Quality Assurance Managers. Radiographers were mainly concerned with the best service, turnaround times, equipment and patient care. The expressions of "best" service are contained in the extracts below:

"Quality service means the best possible service that is provided to our clients which are our patients and it must be of optimal quality with regards to imaging"
(Radiographer 1: Hospital A)

"Well it's doing something properly. We should not just do the bear minimum but do the best we can. You have quality control to make sure what you are doing is the best". (Radiographer 2: Hospital A)

"Ok, first of all quality means you have to have the best images in order to diagnose the patient. The doctors come to us for x-rays so they expect a high quality so that they can diagnose patients with pathology or fractures".
(Radiographer 1: Hospital A)

"Quality meaning to give the best service to our patients. Specifically, to us in the radiography department I would say it means taking the best diagnostic images with the lowest dose possible, meaning not exposing our patients to radiation unnecessarily, whilst at the same time still producing the best quality diagnostic images. This means the doctor must be able to use them to determine what is wrong with the patient". (Radiographer 4: Hospital A)

With regards to turnaround times the following excerpts were used:

“...with regards to turnaround times it must be efficient service”. (Radiographer 1: Hospital A)

“I think it means decreased waiting time”. (Radiographer 3: Hospital C)

Patient care was expressed in various forms in the following excerpts:

“.....even the patient care must be of good quality”. (Radiographer 3: Hospital C)

“I would define quality as a standard of care that we provide to our patients. In terms of the x-rays that they are given, in terms of the care that they are given in the department”. (Radiographer 2: Hospital D)

Two of the radiographers from different hospitals included functionality of equipment in their definitions for quality of the Imaging services as included in the following excerpts:

“Also, quality has to do with your equipment. Equipment has to be fully functioning in order to get high quality images that are diagnostically acceptable. So, if our equipment is breaking down, there is no way that this will be a high quality”. (Radiographer 3: Hospital A)

“.....there must be up to date equipment in working order”. (Radiographer 3: Hospital C)

6.4.2 Theme 2: Inadequacy of clinical provisions

In an attempt to identify factors affecting quality of imaging services, the primary research asked questions that revealed inadequacies and incompetence of the capability of the departments to provide quality imaging services.

6.4.2.1 Patient referral protocols

This section deals with referral of patients to the Imaging departments. Excerpts on requisition forms and waiting times are used to support the statements.

6.4.2.1.1 Requisition forms

Doctors were asked whether there is a request form that they used when requesting services from the Imaging department. One of the doctors expressed their satisfaction with the paper and electronic formats of the request form used in the hospital. The excerpt below illustrates their expression:

“..... when the power is down, we use an old paper version that I am familiar with. The online form gives you a drop-down menu on all the different views you can select. The online version is even quicker than completing the paper one”. (Doctor 1: Hospital A)

On the other hand, in another hospital in which image processing is predominantly digital, a doctor suggested improvement of the request form. In addition, the doctor was concerned that the form is not user-friendly as expressed in the following excerpt:

“Maybe if they improve the x-ray request form itself. I mean the form is quite old and they must have been using it for 20 years or 30 years. That would be a lot better if there was a digital system to order x-rays. Because in private you do not complete the form manually, you do it digitally. Also, the format of the form itself would need to change”. (Doctor 1: Hospital B)

6.4.2.1.2 Waiting times

Participants were requested to comment on the waiting times in their departments. According to responses from the participants waiting times ranged from ten minutes in a digital based imaging department with best equipment to six hours afterhours in highly busy department. These durations of the waiting times are expressed in the excerpts below:

"Patients are x-rayed within 5 minutes; they just get back to the doctor. They don't have to wait for post processing or anything". (Radiography manager: Hospital B)

"Our average patient waiting time calculated in January this year is one hour". (Radiographer 1: Hospital A)

"Ok, because we are DR (digital radiography), our busy times normally is like 30 minutes per x-ray. But our patients wait I think maximum not even 10 minutes. Because if they are walking patients they just come in, get done and they out. Especially also because we are DR, there is no processing, there is nothing to be done". (Radiographer 1: Hospital B)

"The moment they walk in average waiting time I would say is about 10 minutes. That is average on a quiet day it can be five minutes, on a busy day up to 30 minutes. So, it depends on how busy we are on a particular day or how short-staffed we are. We always get complements". (Radiographer 3: Hospital B)

"In terms of waiting times it is ok during the day, like two to three hours but there is a challenge after hours". Unfortunately, the other thing is that we have one CR reader. So, when it's very busy that thing is very slow". (Radiographer 3: Hospital C)

"The normal waiting time is about three to four hours". (Radiographer 1: Hospital D)

"Four hours waiting time is the accepted standard for this department. Most of the time we are within that but there are times when patients wait more or less than that. The times are exceeded particularly if it is a month end or a Monday. They would go up to five hours at the most". (Radiographer 2: Hospital D)

“The average for the day is close to three hours. It can be longer depending on the situation in casualty like if we have trauma from an accident that comes in then obviously it gets longer”. (Radiographer 3: Hospital D)

“Also, a lot of people were not well so that contributed to this. Five people were on sick leave”. (Radiographer 1: Hospital D)

The reasons for long waiting times as expressed by the participants included staff shortages and inadequacy of equipment as illustrated in the following excerpts:

“The other thing is one section of the X-ray department closes for lunch due to staff shortages and patients have to wait an hour”. (Radiographer 3: Hospital A)

“Sometimes you want to have a bedside x-ray and there is only one person especially after hours and you find yourself struggling to get the x-ray”. (Doctor 1: Hospital A)

There were consequences for long waiting times as expressed in the following excerpts:

“They (waiting times) are not adequate, for example there is a case. The patient had distended abdomen; they were querying cancer. So, the patient was sent in surgical ward. Taken to X-ray they said no the patient must come back after six weeks. The patient did not make that two weeks, the patient demised”. (Quality Assurance Manager: Hospital C)

“And lastly for BSU (Bedside unit), because I also work in High Care. In High Care we have patients who are bedridden and immobile that need bedside x-ray. You request an x-ray on a patient that must be transferred from High Care to ICU, the patient will wait for 24 hours for the x-ray to be done. Sometimes that patient might go to ICU without any confirmation. You insert a tube and ask

for an x-ray to see if the tube is in the correct position and that is usually urgent as you need to take a decision". (Doctor 2: Hospital C)

Lastly the satisfaction of participants with waiting times was different from participant to participant and amongst different hospitals. These are illustrated in the excerpts below.

"We meet patient satisfactions in terms of waiting times, I think we have the list waiting times compared to any department because of the fact that we've got the technology". (Radiographer 2: Hospital B)

"The waiting times in this hospital are beyond control and can take up to six hours". (Doctor 2: Hospital C)

"No, we don't get the reports but we get the images sent to us very quickly. Processing is also very rapid as well". (Doctor 1: Hospital B)

"With regards to time there are days when you have patients exceeding their waiting times. And you come into night duty, you take 40 to 50 patients. This is mostly on Mondays; I would say those patients waited between five to six hours". (Radiographer 1: Hospital D)

6.4.2.2 Communication

6.4.2.2.1 Interdepartmental communication

Whilst communication between the Imaging departments was generally not a major issue affecting quality, this was lacking in one of the hospitals. The main issue was the early closure of one of the sections of the department without informing the feeder departments as illustrated in the excerpts below. When asked for the methods in which quality could be improved the Quality assurance manager said:

“They need to strengthen communication between the department and other departments”. (Quality Assurance Manager: Hospital A)

In addition, one of the radiographers in the same hospital was asked if the early closure of the department section was communicated to the feeder outpatient department and they said:

“No, we only inform the patients when they walk here and not the OPDs (Outpatient Departments)”. (Radiographer 4: Hospital A)

6.4.2.2.2 Patient/Staff communication

It was quite evident from the transcripts that communication between staff in the imaging departments and patients was not adequate. This is illustrated in the excerpts below:

“.....let me start. I am going to be brutally honest. As a student I was taught when you call out your patient you don’t refer to them by first name, but you use their surname. For example, Mr So and So or Mrs So and So you see. I have noticed that our students do it and we don’t even correct it because even us as qualified radiographers we don’t do it properly you know. But ok I stick with how I was taught, not to mean that I am back-mouthing my colleagues but that is part of quality and I was taught to call patients in a professional manner”. (Radiographer 4: Hospital A)

“Ok the first one I think of would be to have professional administrative staff, maybe with computer skills. Eh, that can speak professionally to the patients”. (Radiographer 3: Hospital C)

“.....talk to the patient so that they are also comfortable around you. We want to push the lines and thus have no time to talk to our patients”. (Radiographer 4: Hospital A)

Communication between doctors and patients was also lacking and this impacts negatively on the performance of radiographers. This is what one of the radiographers had to say:

“And the other thing is lack of communication because most of our doctors honestly do not do clinical assessments properly. I don’t know how many patients I have received with for example right hand request and when you ask the patient, they say it is the left hand. So, if you just take the two minutes and ask the patient where the problem is they will tell you. Because the clinics are very busy so when they ask the patient where the pain is, the patient will just say it’s the whole arm”. (Radiographer 4: Hospital A)

The other aspect of communication expressed by the participants was the manner in which patients are received in the department. This involved greeting, speaking politely and welcoming patients with a smile. The following excerpts illustrate these expressions:

“Everything, so it will be from the time the patient walks into the department, that they are greeted with a smile, until they leave here”. (Radiographer 2: Hospital B)

“So, I think with us here in this hospital we are very welcoming to our patients. No matter how busy it gets, we always find that time to make sure we take care of that patient. I think that is what helps in the beginning to give good quality”. (Radiographer 3: Hospital D)

One of the participants was of the view that this level of patient care was non-existent in their department. This is illustrated in the excerpts below:

“I think patient care and professionalism from all categories of staff. Just greeting the patient with a smile, you know, speaking politely. These things do not exist in our staff”. (Radiographer 3: Hospital C)

6.4.2.2.3 Communication between doctors and radiographers

In some departments the radiologists hold regular meetings with Clinical Heads of Departments to discuss issues arising from the Imaging department. On a day to day basis, request forms are used to communicate doctors' requests, but at times there are discrepancies with the requests. These challenges and communication methods and their deficiencies are illustrated in the excerpts below:

"Our radiologist would in turn discuss them with clinical heads from feeder clinics during their meetings. Some issues are resolved through the use of email". (Radiography Manager: Hospital D)

".....on the x-ray request form you mention that the patient came presenting with this history and your findings on examination. So you request erect abdominal x-ray because you know what you want but the patient comes back with chest x-ray, it is not what you requested, you then send the patient back and you are re-exposing the patient". (Doctor 2: Hospital C).

".....we have introduced an occurrence book in this department because we found that when we send patients back for proper history doctors do not want to write exactly what exam is required. So now we are documenting exactly where this gap is occurring. I can show you the occurrence book now. That is one of the ways we try and improve quality in terms of Bathopele principles, the one point on redress". (Radiographer 1: Hospital C)

6.4.2.2.4 Communication within the departments

The participants expressed whilst responding to other questions that there were regular departmental meetings held. These meetings are used to discuss issues raised by other departments and Radiography staff as well as feedback received from the patients. The excerpts below serve to illustrate these meetings:

"In unit meetings I get the challenges from the radiographers and I discuss these further with our clinical head. We also have integrated quality assurance meetings where we have Health and Safety, Infection Control so we discuss all related challenges and we put a QIP (Quality Improvement Project) in place". (Radiography Manager: Hospital D)

".....if there are any complaints and then she (Radiography Manager) will bring them up in our monthly meetings". (Radiographer 3: Hospital B)

6.4.2.2.5 Attitude of radiographers

Some of the participants expressed positive attitude and these are displayed in the following excerpts:

"Firstly, staff are happy and we work like a family and that keeps us going. Our management supports us, and they listen to our concerns. They might not be able to fix things, but they listen. If they have to bring the 15th floor (Hospital Management) down to us they do". (Radiographers 1: Hospital A)

"You know I think attitude plays a big role in this service we deliver. We must always remember that people do not want to be here, and they are here because they are ill. So, we need to be compassionate and sympathetic to all of them. And I think all healthcare workers should be like that". (Radiographer 2: Hospital A)

"Ok so quality means a lot of things, quality is firstly the way you dress. You need to be presentable in the way patients perceive you and doctors perceive you. Secondly quality in your department. You must work in a tidy environment. If the cleaner is not there today, make sure you clean, you change the linen when it is soiled". (Radiographer 1: Hospital B)

"The main thing is that the staff is prepared to help the patients. The staff wants the patient to get a quality service. I would like to say even if we experience equipment breakdowns, we do try to use other means to get the images but the

main thing is we don't want to stop and say we are not going to do the patients because the equipment is not working or whatever problem we come across, we do come up with other solutions that may help the patients". (Radiographer 2: Hospital C)

On the contrary some radiographers expressed their concerns for the negative attitude displayed by some of the staff and these are illustrated in the following two excerpts:

"I feel that our attitude as radiographers is a challenge because we just want to push the numbers and forget about patient care, which is very important. When you get to the room you need to get the clinical history from the patient, ask the patient what happened, talk to the patient. So that they are also comfortable around you. We want to push the lines". (Radiographer 4: Hospital A)

"I think one of the stumbling blocks we get is staff attitude. You have people who don't really have that culture of ethics and professionalism. Especially amongst the support personnel, like your clerks, your guard. You have people coming in who will query something like their x-rays and unfortunately they meet a very unfriendly clerk". (Radiographer 3: Hospital C)

6.4.2.3 Image quality

Some of the participants, majority of which were doctors expressed their dissatisfaction with the quality of images. The areas of concern included clarity of images, positioning, image identification and imaging of unaffected (unrequested) parts. These are illustrated in the excerpts below:

"Secondly I would say availability of senior radiographers would be able to make the necessary adjustments in terms of films so that whatever views we request are clear and we don't have to send patients back for repeats". (Doctor 3: Hospital A)

"It changes with time and I think it changes with personnel. Some of the people are not well trained. Because for example yesterday I sent a patient for chest infection, but I could not pick that up on the x-ray as the x-ray was very faint. I had to take bloods to exclude the infection because the x-ray was very faint". (Doctor 2: Hospital C)

"They must train junior staff to take proper x-rays, best quality x-rays, sometimes you send patients during working hours and then the patient comes back with poor quality x-rays or not the right examination". (Doctor 2: Hospital C)

"Our positioning is bad in that for some people if they are doing an ankle, they just need to cover the ankle. But the right way of doing it is using the central points that we learned from university, the landmarks we use and all those things". (Radiographer 4: Hospital A)

"Those are the things that we have to watch because sometimes you are working long night and you say you know this is difficult patient and we send it through. You know it's a bad image, but you send it through. Those are the things that negatively affect quality". (Radiographer 3: Hospital B)

"Two if they do the images that we ask for. You ask for a radius and then they just do wherever the patient says it's painful. Three if they can print good quality films, not over penetrated or under penetrated". (Doctor 1: Hospital C)

"With some disciplines such as orthopaedic x-rays that we order, we have some issues with them. If we request specific x-rays we don't get those x-rays. It is simple things like if you request a specific joint like an ankle, the x-ray must be cantered at the ankle, but we end up with an x-ray of the entire lower limb". (Doctor 2: Hospital A)

"Thirdly all the information of the patient must be written correctly on the x-ray so that I do not read an x-ray that actually belongs to another patient. Because

it does happen that you send Mr Mnguni to x-rays and you get x-rays of Mr Harripersad". (Doctor 1: Hospital A)

On the other hand, there were some participants who were satisfied with the quality of images as expressed in the excerpts below:

"Quite good compared to the quality we get from the private sector where I work the other four days in a week. I occasionally go and ask for something to be clearer but in general quite good". (Doctor 4: Hospital A)

".....but the images performed by the Radiology department are very good". (Doctor 1: Hospital B)

"With regards to mammo (mammography) and CT (Computerised tomography) we have one of the best as our doctors are very thorough". (Radiographer 1: Hospital A)

"I find that mammo has very high quality and the reason I say that is we receive praises from patients as they are a testimony to our quality. With regards to general radiography we tend to drop our standards. We are worried about patient numbers and no quality" (Radiographer 2: Hospital A)

There was evidence that radiographers are aware of the type of image quality they should be producing as can be noted in the excerpts to follow:

"For example, when it comes to our x-rays the quality of that x-ray must be optimal in order for doctors to diagnose patients correctly". (Radiographer 3: Hospital D)

"Most important is quality of our x-rays because in radiography we are the eye of the medical field. So, the radiologists and doctors make a diagnosis from the x-rays we take. We must make sure that we produce good x-rays". (Radiographer 1: Hospital B)

6.4.2.3.1 Image acquisition protocols

It was reported that in some hospitals there are no protocols prescribing the set of projections/views for each examination. In addition, the computed radiography images are printed on incorrect film sizes when the correct sizes are not available, and this affects image quality in a negative way. The following excerpts demonstrate these aspects of image quality:

“No, I don’t recall seeing a protocol”. (Doctor 4: Hospital A)

“.....we do not have protocols. Even if the doctor requests an erect abdomen you just have to do it even if you think it is not necessary”. (Radiographer 1: Hospital A)

“With protocols you need the guidelines. You get a patient for acute appendicitis; you do erect chest and a supine as this is the protocol. The doctor sends them back for supine. So, the patient has to come back, and the disease continues and the patient takes up someone else’s time. My morals get low quite low and stress shoots up”. (Radiographer 1: Hospital A)

“I would say that our management needs to draw protocols for emergencies. Because on a night shift instead of doing important things like say CT scan, we stuck in trauma doing cold cases that are not an emergency you know. So that is what I think our management needs to do because we do many unnecessary x-rays but for what, for nothing. Like the other day I had to do a chest x-ray for a strange behaviour. We speak about these things and nobody listens to us. We are doing all those unnecessary exposures to patients, these need to be addressed but nobody addresses them”. (Radiographer 3: Hospital A)

“We don’t have really the protocol regarding x-rays. We go by clinical judgement, then we phone for special investigation like CT scan to discuss with the radiologist then we book the examination. You can’t just fill a form and send a patient, no you’ve got to discuss each case with the radiologist”. (Doctor 1: Hospital D)

"I would not say quality in this department is up to standard honestly speaking. We are taught the correct views at varsity that for example AP (anteroposterior), Oblique, lateral but you sometimes see people just doing an AP and then you think what about the lateral because it is to see if the fracture is accompanied by a forward or backward, displacement". (Radiographer 4: Hospital)

"And our films are out of contract so even if we have procedures that we know should be printed on a 35cm by 43cm film, we print on a 24cm by 30cm for example the T/spine (thoracic spine) and the L/spine (lumbar spine) because we are out of contract and the department doesn't have money. And when the radiologists report they want the big films, unfortunately we don't have". (Radiographer 4: Hospital A)

"Thirdly sometimes it happens that they squeeze more than one image in one film. You find that they are very small. You find there is a pelvis, there is a knee, and there is an ankle in one film. It makes it difficult to diagnose properly". (Doctor 3: Hospital A)

6.4.2.3.2 Image analysis and feedback

The participants cited that image/film reject analysis is conducted in most regional hospitals in the eThekweni District. Some participants stated that the reject rate was within the accepted norms. These claims are illustrated by the following excerpts:

"The department also look at the reject analysis from the CR system". (Radiography Manager: Hospital A)

"Reject analysis is done on a monthly basis in trauma and main. In another section it is done weekly". (Radiographer 1: Hospital A)

"..... it (reject analysis) does happen with digital work. For the most part I have not gone over the 10% standard so to speak". (Radiography Manager: Hospital B)

“In this hospital in terms of our reject analysis, in terms of our x-rays we always have a reject rate of less than 5% unless we have our students because here we do not have the darkroom”. (Radiographer 1: Hospital B)

Whilst reject analysis was performed in most regional hospitals, there was one hospital in which this was not done. The excerpt below illustrates what the participant from this hospital explained:

“We used to do the reject analysis when we had a darkroom. I think when they did come, I can’t remember if they did show us but honestly, we don’t do it. The thing is we hardly have repeats and if we do, we do not really reject a patient’s image, we simple leave it with a patient’s details”. (Radiographer 2: Hospital C)

The participants further explained that in some departments weekly image reviews were done to deal with reasons for image rejection. The following excerpts are evident to this:

“We also have a peer review programme. It is done weekly by one of our assistant directors, she collects films through the week, and we look at how it could have been improved. If the problem for example is positioning, a radiographer who can explain it explains it to the rest of the staff”. (Radiography Manager: Hospital A)

“.....so, the QC manager (Assistant Director within the department assigned by Radiography Managers to do Quality Control) for that week will pick up where the radiographers have a problem. Most of the time the training is done by the most senior person available but anyone who feels comfortable to explain whatever is welcomed to do so. So, the QC manager makes notes of who does a particular projection better and they ask that person to assist”. (Radiographer 2: Hospital D)

On the other side whilst there is a hospital in which reject analysis is not conducted at all, there is another one in which the results would not be used for quality improvement or anything at all. The following excerpts illustrates this:

“When results of the reject analysis are received nothing gets done about them”. (Radiographer 1: Hospital A)

6.4.2.3.3 Image quality control

The transcripts revealed that in most hospitals there is a senior member of the radiography personnel (usually one of the Assistant Directors) who reviews the images before they leave the department. This is supported by the excerpts below:

“...we produce quality radiography because we have radiographers that produce good x-rays, we have a manager that ensures quality control of x-rays, and so x-rays that are going out during the day have quality despite the fact that the equipment is not 100%”. (Radiography Manager: Hospital D)

“.....but in terms of the quality of images that are being produced, I feel they are of high quality. We have a system in place which is quality control”. After we do the images, the Assistant Directors see if they are satisfactory like if you struggle, you can also speak to them. If you are struggling with a particular view, let’s say you have attempted it twice and you are unsuccessful, then you go to whoever is on Clinical Supervision, they come and they assist you with that certain view”. (Radiographer 1: Hospital D)

The excerpt below indicates that the practice of quality control is not performed in Hospital A:

“With regards to general x-rays there is no monitoring as there is no daily QA (Quality Assurance) for x-rays to be checked before x-rays go to the doctor. If the radiographers feel a slanting image must go, it goes”. (Radiographer 1: Hospital A)

6.4.2.3.4 Repetition of images

The participants were asked to state the reasons for repeating imaging examinations. Many issues emerged from their responses including equipment faults, patient related problems and radiographer related shortcomings. These are illustrated in the excerpts below:

“Bad technique, patient movement, equipment is functional and should not be a problem”. (Radiography Manager: Hospital A)

“The main contributor is obviously equipment failures; exposure factors are so different. Sometimes in the same x-rays rooms exposure factors change like three times in a day. The second reason why we repeat is positioning. The other thing is if there is no marker, we do not put a film through”. (Radiography Manager: Hospital D)

“Incorrect exposure technique, it is hardly ever positioning. Also, with regards to off centring of the machines”. (Radiographer 1: Hospital A)

“.....so exposure factors due to chemicals are a challenge. Sometimes the exposure factors in the rooms fluctuate. So, we really don’t know, today we use these exposure factors and tomorrow we have to change them. So that is one of the things that cause repetition of x-rays. So, the only reasons you would repeat is positioning or patient movement. Most repeats are from patient related problems”. (Radiographer 3: Hospital A)

“Exposures especially here, for our students I would say it is more technique for most of them. We get a lot of repeats when we have student because they rotate to different hospitals so when they come, they need to adjust from digital to our CR and conventional processing. When I work with students, before we do an examination for example a chest, I ask them about the centring point. It is surprising that some of them are doing second year and they still do not know the centring points”. (Radiographer 4: Hospital A)

“If we do repeat, most of the time I would say it is artefacts. You know our patients like sometimes they don’t take off some clothing. Some of them love to put on safety pins. So, artefacts cause the repeat of x-rays. Obviously also some difficult patients that are not easy to position”. (Radiographer 1: Hospital B)

“.....one is like certain people don’t centre properly like at the beginning of the year we have new staff, they are usually not aware that this room is not centring properly. So, equipment in that sense”. And I think positioning as well. Also like in terms of our images, if it does not have an anatomical marker we have to repeat. We don’t use the markers from the CR system. Another repeat that we get often is caused by the bigger patients that we x-ray ...So you would find a lot of grainy appearance”. (Radiographer 1: Hospital C)

“I would think very difficult patients who do not come up with a porter or escort. Also due to it being so busy in our department, we often rush to do the patients so human error to forget to do something correctly can lead to a repeat. Because it’s so busy we try to push the work instead of focusing on what we do. Also, what has been a challenge for me personally is QC. Sometimes having a QC Manager can delay the process and very often they would ask for ridiculous repeats. But mainly we repeat when we have difficult patients without an assistant”. (Radiographer 3: Hospital D)

6.4.2.3.5 Radiology reports

There is more than sufficient evidence pointing to the insufficiency and absence of radiology reports in regional hospitals within the eThekwin District. Participants were asked about the availability of radiology reports and the participants expressed their concerns about the insufficiency or unavailability of this service. The following excerpts serve as illustrations:

“.....that is one of a big problems and that one is a big problem, we were struggling to get a radiologist and our CT scans were done outside the hospital and that is where we need a radiologist. We hardly request for reports on

general x-rays and I cannot even remember when last I required that service".
(Doctor 1: Hospital A)

"No, we don't get reports at all, but also to be fair, the number of x-rays that we request, I don't think it would be feasible to get a radiologist's report on all of them. However, the service is available, so you can request. But is also very much consultant dependant and some of us would go down to discuss it with the radiologist". (Doctor 2: Hospital A)

"Almost none, it's been a couple of years since we received the reports due to short staff. Unfortunately, we have to interpret ourselves. I think you can request but we hardly request because it takes time". (Doctor 4: Hospital A)

".....we don't get reporting anymore because there is not enough radiologists".
(Doctor 4: Hospital A)

"The other thing is we should start reporting on all images. Because there are so many x-rays done in a day and none of them are reported on. And I think as a hospital in Durban that should be happening". (Radiographer 3: Hospital A)

"She does not report on everything, she only reports on Ultrasounds and CTs and if they request an x-ray report". (Radiographer 1: Hospital B)

Two participants were further concerned about the consequences of the unavailability of image reports. They cited patient throughput and management, possible misdiagnosis and effects on service delivery to patients. These are illustrated in the excerpts below:

"We don't have a report on the x-rays. Unfortunately, this slows down service delivery. The time it takes me to read an x-ray of which I'm not a specialist at, I could attend to another patient. The other side of the story is that, because I am not a specialist in reading x-rays, there are things that I will miss that a specialist radiologist would pick up. So, there is also a possibility of misdiagnosis". (Doctor 1: Hospital D)

“Also, the radiological services kind of cripple our quality. Unfortunately, patients don’t get a full service as they should”. (Radiographer 3: Hospital C)

Two of the participants who were doctors working in Orthopaedic and Accident and Emergency departments expressed their ability to manage patients without the radiologist reports. They alluded that due to their experience in their respective sections, they were able to interpret images on their own. These are contained in the following excerpts:

“.....in our department (orthopaedic), I think because of the experience we have, we don’t normally request for reports. We just interpret them you know. It happens occasionally that we request for a report, especially in the area of spine examinations. For malignancies basically, yes, we do request for reports. And when we do we receive them promptly”. (Doctor 3: Hospital A)

“Because we are doctors, in the Accident and Emergency department we use to interpret the x-rays on our own. The reports are not so much of a necessary thing for us to manage the patients because we just make the assessment on our own”. (Doctor 1: Hospital B)

6.4.3 Theme 3: Leadership and management

There is a need for improvement of coordination at management level to ensure adequacy of hospital wide resources like patient trolleys and wheelchairs. In addition, there is another challenge posed by non-functioning of lifts in tall structure hospitals. The following excerpts are evident to these claims:

“I think the issues on this one is more hospital challenges than x-ray. Like one day we found a patient in labour outside the X-ray department because there were no wheelchairs or trolleys to take her. Sometimes you find patients for ankle limping to the department. After you process the x-rays and you see a huge fracture you wonder how they got here”. (Radiographer 4: Hospital A)

“There is also a problem at times with lifts as our hospital is a tall structure. But we have multiple lifts”. (Quality Assurance Manager: Hospital A)

“No, all patients come here. TB and all patients come to one place”.
(Radiography Manager: Hospital D)

Other areas affecting leadership and management relate to roles and responsibilities, accountability, monitoring of working hours and the NCS. The data on all of these is presented below.

6.4.3.1 Monitoring of working hours

Some of the participants expressed concern over the early closure of imaging services in some of the sections with the Imaging departments. According to the participants the early closure was not communicated to the affected sections of the hospitals and negatively affected quality of services. The participants also complained that some of the night shifts were too long. The following excerpts are an evidence to this:

“The other one is only trauma x-rays works 24 hours. One section of the X-ray department closes at 15:00 and main x-ray closes at 16:00. The patients go there (Main x-ray) and they are for example number 20 and the clerks feel the patients will not be able to be processed and send them to trauma. But no patients would be sent home due to x-rays not being available. The departments around the section of the X-ray department that closes at 15:00 close at 16:00”. (Quality Assurance Manager: Hospital A)

“I also want to mention that we do operate at another regional hospital in the District as well. So, when we work there, we find that the radiographers, they only work up to half past three. So, if you have an operation that extends beyond that, you are stuck because they will go at 15:30”. (Doctor 3: Hospital A)

“...they have to close the department at lunch time, and this happens a lot of times because we are short staffed. They say before I came here people used to get relief from the main department. But if they are short and there is no one to relieve you for lunch, so we tell the patients to wait for one hour. Sometimes

it becomes an hour and thirty minutes because you have not had your tea break. So, you need that time to relax a bit". (Radiographer 4: Hospital A)

"It depends who is working here some people at times just feel it's the knock-off time even at three. That's the thing the people here can get away with things and nothing will be done. Like they decide to go at three and no person will ask but say it's me for example and it's going to be a big thing you see. It depends on who is working here. Because at the end of the day the radiographers are the ones who determine if we work or not". (Radiographer 4: Hospital A)

"Also, the hours we work, that is probably a negative. We work a 14hour night shift.So, at the end of that week we work 72 hours. Like I said at the beginning that is the biggest constraint especially a person with two kids and a young family. The commitment is important for us. Bear in mind you don't have an official break because you work alone. So that does not get compensated in any way". (Radiographer 2: Hospital B)

6.4.3.2 The National Core Standards

6.4.3.2.1 Knowledge of the National Core Standards by radiographers

The participants were asked about their understanding of the NCS and most of them had no knowledge of the NCS. The following excerpts illustrate the responses to this question:

"I am not familiar with the National Core Standards and I have not undergone any training/workshop. Most of the ADs are familiar with that. Last time we got assessed they targeted certain things. It could have been different. Each examination room should have a sink and they must look at that". (Radiographer 2: Hospital A)

"Not much, I have been working here for four years now and I have not been part of a meeting on the NCS. If there is somebody coming to inspect the department, they do tell us. It is not something that we talk about." (Radiographer 3: Hospital A)

"No, I don't know. We have not had a departmental discussion on those".
(Radiographer 4: Hospital A)

"Access to patient rights, access to patient care, and the patients have the right to go for the second opinion". (Radiographer 1: Hospital B)

"I know that it involved the patients and their rights, and their safety and how we care for them. I know that it was looking at the whole structure as a business and how well it is run. They would use patient complaints and complements to assess that. And also involves Bathopele and patient right". (Radiographer 2: Hospital B)

".....they usually prepare us for answering the questions. But I don't think any one of us has a good understanding of what the NCS are". (Radiographer 3: Hospital B)

"I think that the National Core Standard is a standard that was set to ensure that the hospital or department brings quality. It covers a lot of things. It covers infection control; you know all that is to ensure that the NCS are met by each and every department. So that is what I understand, they were set so that each and every one complies with them". (Radiographer 2: Hospital C)

"The National Core Standards, I think it has to do with six priority areas. COHSASA is one of the things we had heard so far. But we have been doing them for I think four years but it has not improved the quality of the department. Equipment is still an issue so the standards are not helping where we have a problem. There should be something better to deal with these matters".
(Radiographer 3: Hospital C)

"National Core Standards is a standardisation of something. I am not so sure about the NCS. And I cannot mention any because I forgot about them. However, we have been trained on these but I just cannot remember now".
(Radiographer 2: Hospital D)

"I always forget the National Core Standards; I am not going to lie. But we are made aware of them though I am always away when they have in-service training on them. We do have in-service training that we do every Wednesday. If it's not peer review, it would be on infection control or NCS". (Radiographer 3: Hospital D)

6.4.3.2.2 Relevance of the assessment tool

The primary researcher asked participants about the relevance of the tool used during licencing inspections. As stated by the participants in the previous section, Radiography Managers are the most involved people with the NCS and thus two of them stated some concerns regarding to tool as well as the process of licensing inspections. The concerns raised included the currency of the tool. The following excerpts demonstrate these concerns:

"I think it is a bit outdated in that it is still addressing some of the old technology, regarding quality statements around equipment. Like darkroom fog tests. Supervision as well, how they assess supervision, there is a staff interview. And they ask for six monthly reports, or annual report on radiation safety measures". (Radiography Manager: Hospital B)

"The questions there are not up to date. Some of those questions like the darkroom do not apply any more. Licensing certificate does not apply any more. The SAHPRA Board only comes in three years and say if we are compliant or not. So some documents requested are not in keeping with the latest developments in the field". (Radiography Manager: Hospital D)

"...there was a time when we did not have endotracheal tubes. We actually did have them, but they expired. These were sent to CSSD for autoclaving, but they want things in their original packets. Another thing, the assessors marked us down because of the darkroom. They did not take into consideration that we no longer use the darkroom. Here we go, they said the following tests were not done, darkroom fog level. When we explained that this is what we are doing,

they acted as if we wanted a short cut". (Quality Assurance Manager: Hospital B).

Two recommendations for improvement of the tool and process were suggested and these are presented in the excerpts below:

"They need a more structured staff interview. How do you measure supervision? So, people will they have got chiefs on the floor and that is not good enough for me". (Radiography Manager: Hospital B)

"It would be nice if they consult with relevant managers so that the tool is relevant. The input of radiographers on the ground when devising these tools is important". (Radiography Manager: Hospital D)

"The question is whether these people are trained in what they are doing" Because even if you are in doubt, take whatever the people are telling you, go back and verify. They did not want to hear anything". (Quality Assurance Manager: Hospital B).

6.4.3.2.3 Departmental performance during inspections

The Quality Assurance Manager s were very happy with the performance of the Imaging Departments during the inspections. All the regional hospitals in which the data were collected obtained above 90%. The areas in which scores were lost included missing items from the resuscitation trolley, explanation of the call-out systems and obviously the issue of the darkroom as raised above. These are demonstrated in the following excerpts:

"The scores are good because the gaps do not arise from the core x-ray functions of the department. They failed on some missing items from the resuscitation trolley. They also could not explain the call out system. They could not explain how the emergency x-rays are to be obtained. Overall, they scored 92.2% during the previous inspection". (Quality Assurance Manager: Hospital A)

“More than happy, they get above average, above 80% and they do corrective measures as well. They do them on time and they don’t wait for us to chase them. They are currently sitting at 93%, actually you can say 94 because this is actually 93.8%”. (Quality Assurance Manager: Hospital B).

“For this one in June 2019 they scored 93%. So out of 16 questions they scored 14. So, they did well”. (Quality Assurance Manager: Hospital C)

6.4.4 Theme 4: Facilities and resources

Participants were lamenting for adequacy of equipment and staff numbers throughout the interview. There is a strong belief that these are the most determinants of quality in Imaging Departments. The following excerpts are a clear demonstration of these lamentations:

“We are extremely busy on the days when the clinics are very busy, because we are 23 and have two and a half functional x-ray units. So, we battle in terms of getting through those patients”. (Radiography Manager: Hospital D)

“I mean honestly there are some things you wish they could do here that we don’t have. Like we don’t have after hours CT here at this hospital because we don’t have a radiologist after hours to report on scans for us. Also, we only have one person from ultrasound so it would be a lot better if we could have maybe a medical officer in Radiology or something because the radiologist does not do call and night shift”. (Doctor 1: Hospital B)

“Even our mammogram bookings are gone to November 2020, CT gone to about July 2020, Fluoroscopy to April 2020 and ultrasound 2021”. (Radiographer 1: Hospital C)

“No, if we get computers tomorrow, we will be in trouble. Currently they clerk patients by writing down. Currently we have a shortage of admin staff due to deaths and resignations. The darkroom operators were converted to clerks

when we migrated to CR and these people were level four. They are very slow even with writing". (Radiographer 3: Hospital C)

"So, if we have better equipment and we have more staff quality could be better because we cannot control patients and we cannot turn patients away". (Radiographer 2: Hospital D)

"Number one, equipment, this whole department needs to be changed into digital because we are so behind with technology here. I would employ more staff; I would also buy a Lodox machine to deal with the trauma we do here". (Radiographer 3: Hospital D)

Two participants raised concerns regarding the quality effects on the introduction of the eminent insurance health insurance gazetted by the government. This is evidenced by the following excerpts:

"Adequacy of staffing and equipment should be considered as we go closer to NHI (National Health Insurance)". (Radiography Manager: Hospital A)

"I mean we are told that NHI is coming and we find ourselves at the hospital where we don't get all we want and then we are told that there is systems coming into place and even now we are struggling to get what we want so we don't know how this NHI is going to work for us and how is it going to benefit the patient. The only benefit will be those people who do not have medical aids and all those types of thing. But everyone should be getting the equal share in the budget not one hospital more than the other hospital". (Radiographer 1: Hospital C)

Data on other aspects of facilities and resources including imaging equipment, servicing of equipment tests, equipment repairs, and image processing equipment are presented in the following sub-sections.

6.4.4.1 Imaging equipment

Participants were requested to comment on aspects that negatively affect quality of imaging services. In addition, they were also asked to recommend actions that need to be undertaken to improve quality of imaging services. This section presents responses that related to issues around equipment. The main issues on general imaging equipment related to shortage of equipment, currency of equipment and other forms of inadequacy. The following excerpts illustrate these sentiments:

"We don't have enough equipment. We don't have high-tech equipment. We've got the basic x-ray units. We can do more in terms of producing the package of care that we offer in our institution if we had better equipment". (Radiography Manager: Hospital D).

"They need more machines so that the patients do not wait so long for x-rays". (Doctor 1: Hospital C)

"We have got minimal functioning equipment. We have machinery but we do not have enough to offer the service we should be offering. Most of them meet the minimum standards of functionality. We have to cut down on service delivery which impacts on patients. We have had to close some departments due to machine not being fixed when broken". (Radiographer 1: Hospital A)

"But also, we have two rooms working in main out of the four, in another section there are three rooms working and only two are functional, trauma has two and one is working". (Radiographer 1: Hospital A)

"You cannot have a full department with just the two machines". (Radiographer 1: Hospital A)

"The next gap is equipment failure. It is not being timeously repaired, not getting the equipment we require, and it's a long process to get the equipment". (Radiographer 1: Hospital C)

“There has been no collimator in that room for about two or three months now. We are basically working with two general rooms at the moment, room 5 and room 8. Room 7 which is a fluoroscopy room is used to do chest x-rays. If we can begin to say this is not the way it is supposed to be, it will come to a standstill in any way. But we have no choice because our patients are here, and we cannot turn them away”. (Radiographer 1: Hospital C)

“I think equipment, I mean we work with whatever equipment we do have, producing good quality work but I mean like we do struggle in terms of equipment. There are some of the equipment you cannot use for everything like Room 1 you can use for certain thing, Room 8 you can do certain things. Because there are limitations to that equipment.like let’s say if you have an mva (motor vehicle accident) you can use Room 1 because the tube can turn”. (Radiographer 1: Hospital D)

“The second thing I think would be ceiling suspended x-ray tubes, also we need to be fully digital to lessen the waiting times”. (Radiographer 1: Hospital C)

“Because some of our rooms are out of order even condemned. And there is space available for more x-ray equipment to be put in. We are limited to three rooms at the moment. We can do MVAs in only two of them”. (Radiographer 2: Hospital D)

“Ok I will relate it to our institution. The terrible equipment that we have, the quality is very suboptimal, working under the conditions that we do, it is very difficult to give that quality. More than often we have to go in and redo the patient because the machine gives a flash exposure and there is nothing we can do unless just to repeat it. Our equipment is a major setback in quality”. (Radiographer 3: Hospital D)

It was however encouraging to hear that there is a hospital in which equipment was not so much of a challenge. The following excerpt illustrate this expression from one of the participants:

“We’ve got good machines for general radiography though, so our challenges are not related to machinery”. (Radiography Manager: Hospital B)

Some of the participants expressed dissatisfaction with non-functioning of the specialised imaging equipment. Equipment in this category include CT scans, fluoroscopy equipment, mammography and ultrasound and one or more of these are not working in each of the regional hospitals in which data was collected. These challenges are illustrated by the following excerpts:

“We have not had fluoroscopy for example in the last three years. Our CT scan, we are running a good service and our ultrasound package we running a good service”. (Radiography Manager: Hospital D).

“We have a backlog of 632 patients for mammography. We tried to get assistance from a tertiary hospital in the district. An SOP (Standard operating procedure) is currently being discussed for them to assist us. Another regional hospital is helping with CT. With the tertiary hospital staff will not have to go with patients because staffing is an issue”. (Radiography Manager: Hospital A)

“Sometimes ultrasound and CT scan are not readily available. At one time the CT scan was down for a very long time. When equipment is broken, we send patients to other hospitals where there is only one and this causes problems for everyone. Patients have to be transported and it is a huge challenge for us.” (Doctor 4: Hospital A)

Two of the participants were particularly concerned about Lodox machines used for multi-trauma imaging. There were however contracting statements regarding this piece of equipment. Whilst one participant was longing for the purchase of the Lodox two of them stated that it was available. Two participants from the hospital in which this was available were concerned that it was not being used. Again, difference reasons were stated for it being unused as one stated that the doctors did not like its images whilst the other one stated that

the Lodox was out of order. These views are illustrated by the following excerpts:

“...if we can have a Lodox machine. I know it’s expensive but for polly trauma cases it would be very useful”. (Doctor 2: Hospital A)

“I would also buy a Lodox machine to deal with the trauma we do here”. (Radiographer 3: Hospital D)

“Yes, we have a Lodox and it is functional, but the doctors don’t like us to use it. They want the images all separated, like they want proper skull x-rays, they don’t want the x-rays just like one scan, they don’t want the images like that. Then if we have to print it like that, we have to ask them to view the x-rays in the department. They don’t want to do that as well, so it is not being used optimally like it should. But yet we have cases where all are multi-trauma”. (Radiographer 1: Hospital C)

“.....with the Lodox it can only do a certain number of patients because it overheats. Even the aircon there is also a problem. But, if that fails, we try and do emergencies in a Lodox. And then all other patients have to come back during the day the following day”. (Radiographer 2: Hospital C)

6.4.4.1.1 Quality Control Tests

It was quite evidence that quality control tests were performed in most imaging departments. There are however challenges in performing these on a regular basis in some of the departments. Work overload seems to be the leading contributor to this irregularity. The following excerpts are evident to these observations:

“We have challenges, but we obviously strive for quality, quality control tests are done, we comply with SAHPRA requirements”. (Radiography Manager: Hospital A)

“.....there is quality assurance that is done by our managers in terms of tests and other quality assurance”. (Radiographer 2: Hospital C)

“Then our quality assurance tests, some people do them sometimes we don’t do them. Because you can say time constraints, I don’t know but we know that warming up the tube every day for example increases the tube life. Because we are so pressed for time, we just get the first patient in and move on you see”. (Radiographer 4: Hospital A)

Close monitoring is required to ensure that the tests are performed regularly. In addition, support in terms of areas where training is required needs to be offered. The following two excerpts illustrate these observations:

“And even when you behind them (radiographers) they struggle to get them done on time because they have a shift work because radiographers plan poorly. You have to tell them it’s their baby, it must be done by this date, if you not behind them, it won’t be done, and I have the map out to be behind everybody. I also discovered that the knowledge on how to do the tests was so poor. They were not doing those tests correctly, so we had to train them last year”. (Radiography Manager: Hospital B)

“.....we do a lot of in-service training in terms of QA projects. Mostly its image quality and maintenance of equipment. So, we do a yearly thing where we get allocated Quality Control like the tests on equipment. We tend to change around so that nobody is doing the same thing every year. So, in that way we get to learn tests to be performed in different equipment in the department”. (Radiographer 3: Hospital B)

6.4.4.1.2 Equipment repairs and servicing

When asked to share their experiences on issues affecting quality of imaging services, most of the participants used this as an opportunity to voice out their frustrations and stressors. Whilst there might be sufficient number of imaging rooms in most departments, many of the equipment in those rooms were non-

functional. This resulted in incapacity of the departments to deal with high levels of workload. The reasons for non-functioning of equipment were due to delays in repairs as well as lack of servicing. The following extracts from the transcripts reveal these deficiencies:

“Another thing is malfunctioning of equipment, for example maybe you find that out of ten x-ray machines, it is only three or four that are working. So, you can imagine the workload now”. (Quality Assurance Manager: Hospital C)

“Another resource in our case is equipment. You have just one room and you want to rush to use that room”. (Radiographer 2: Hospital A)

“...as a radiographer I try to work with whatever I have, so if the equipment is faulty you try and improvise and try to make it better. I think that my manager tries every possible thing that he can do to make sure that services are of high quality you know. Like if there is a breakdown he tries and make sure that the technicians come out as soon as possible”. (Radiographer 3: Hospital A)

“I would think that we need to get more x-ray machines working in terms of main and trauma x-rays because those are our two busiest departments. So, on a night shift when you work in trauma, you can’t really do much because there is only one room working. So, if there was another room working then each of us would get a patient into each room because there is two of us”. (Radiographer 3: Hospital A)

“Our quality is also affected by the fact that our machines are no longer on contract and to fix them is a lot of money. And the time they take to fix the machine is longer and that affects the quality that we are producing”. (Radiographer 4: Hospital A)

“We have two rooms that are working but we only use one room because the other room is very old. The exposure factors do not correspond with those on the chart. So, we run away from that room and that affects patient care because

we want to use a room that you know if I use it, I am not going to repeat. In addition, the table does not move up and down. Imagine a patient with an external fixation. Like now, I had a patient who only has one arm and she has an external fixation. Imagine she cannot even lift herself up, like literally".

(Radiographer 4: Hospital A)

".....I think the third one would be to deal with equipment breakdown".

(Radiographer 3: Hospital C)

"Another issue I think is equipment faults, lack of servicing and I think the process to get technicians here is too long, so equipment is a major challenge as well". (Radiographer 3: Hospital C)

Some of the implications for non-functioning equipment as cited by the participants were lack of time to engage with other responsibilities (a good example, would be QA tests), poor image quality, impact of workload on Imaging departments in other hospitals, inconvenience to patients and staff and delays to patient management (example cancer patients). These concerns are illustrated in the following excerpts:

".....whereas if you have more rooms, every radiographer will take a specific amount of patients and obviously it means you will also have enough time to do whatever needs to be done. We tend to drop our standards because everyone is waiting for one room and we rush our patients". (Radiographer 2: Hospital A)

"For example our CT scan has been broken for almost a year now and we have to trouble other departments and patients and ourselves and the quality of service we are producing because the turnaround times for the results to come is longer than it would be if the patient was scanned at our hospital. This is very sad because most of the patients affected are oncology patients and those are the ones that need results immediately you see". (Radiographer 4: Hospital A)

Two participants from one of the regional hospitals expressed that they did not have many equipment related challenges and this is captured in the following excerpts:

“The equipment is manageable. I mean when there is a break down the technicians are quite ok”. (Radiographer 2: Hospital B)

“The equipment is not bad because we are relatively new, and we just got maintenance on contract basis. If we do have a problem, we just call a technician and say this is the issue, please come and sort it out” so they just come and fix it. So, we are fortunate that we don’t have long waiting times so we are good in that sense. We do have issues with equipment occasionally, but they get sorted out very easy, within a few days, a week at the most, our machines are up and running again”. (Radiographer 3: Hospital B)

6.4.4.1.3 Equipment replacement plans

Participants explained that the lack of an equipment replacement plan was the major reason why some equipment would be non-functional for long lengths of time. The following excerpts are evident to this claim:

“We also need better equipment because our equipment is very old”. (Radiographer 2: Hospital D)

“In terms of equipment, we just need equipment that will help us to get through the 300 patients we get each day”. (Radiography Manager: Hospital D)

“.....and some equipment being absolute and not being replaced. Fluoroscopy has not been functioning for the past four to five years and is being replaced now. The mammo unit was not working for a year before we received a new one. Mammo has been cut down to two days per week from three days and there are no biopsies performed”. (Radiographer 1: Hospital A)

There is a certain level of equipment replacement although it is rather a bit behind. The following excerpts illustrate that some equipment is or has recently

been replaced in some of the Imaging departments. In some cases, there is hope that equipment will be replaced soon:

“What has happened is Room 1, Room 4 and Room 6 equipment has been taken away and we have requested for digital equipment to come into those rooms”. (Radiographer 1: Hospital C)

“CT was down since February the 13th this year and is currently being installed”. (Radiographer 1: Hospital A)

“The main challenge is unavailability of the CT.... they are still busy with installations and patients had to be transported to other hospitals. Staff from our department would have to go with that patient to image them there. CT patients would have to be admitted”. (Quality Assurance Manager: Hospital A)

“We have procured three new equipment, CR reader, Fluoroscopy unit and a CT scan”. (Radiography Manager: Hospital A)

6.4.4.1.4 Image processing systems

Image processing in Imaging Departments within the eThekweni District is a combination of conventional /wet processing, computed radiography (CR) and digital radiography (DR) with PACS. One regional hospital has a combination of wet processing and CR with majority of the processing being done through CR. In another hospital there is a combination of CR and DR with a full PACS. Two of the hospitals are running on CR only with printing of images on film. The following excerpts are evidence to these provisions:

“In one section of the department we use the old conventional system of image processing so exposure factors due to processing are a challenge. In other two sections we use CR and there is not much repetition unless it's your fault”. (Radiographer 3: Hospital A)

“We do not have digital but running analogue on CR”. (Radiography Manager: Hospital D)

“Also, we have a PACS system”. (Radiographer 1: Hospital B)

“We just got a CR”. (Radiographer 2: Hospital C)

The number of CR units at the time of data collection was insufficient and this affected service delivery in a negative way. In one of the hospitals, there was one CR unit and it consistently broke down mainly due to overuse. The excerpts below are an illustration to this fact:

“The CR unit was brought in to actually bring change but at the moment because it’s a single CR that we have, it breaks quite often so it’s hard to give patients a quality service in terms of that as well”. (Radiographer 2: Hospital C)

“.....one CR for all the images. 24 hours, seven days a week. The second CR reader has to go to our orthopaedic department because we have another department in orthopaedic which is completely down”. (Radiographer 1: Hospital C)

“We have asked for the second CR reader, the CR reader is impacting on the waiting times and putting the strain on the CR equipment itself”. (Radiographer 1: Hospital C)

“We need a CR reader, and this is in the plan”. (Radiography Manager: Hospital A)

Only one participant complained about the PACS as they compared it to another model elsewhere. The following extract from the transcript illustrates this concern:

“I think, I like them, they are quite good, but I find that this PACS system that we use is quite difficult to use because of the layout and functionality. When you open up an x-ray, you have to literally open up the file, so if you did a series of x-rays, four or five, you have to manually open them one by one. I also find that the tools to magnify and manipulate the image so that you can see clearly

are quite difficult to use in this PACS system. When I worked in the Northern Cape, their PACS system was much more user friendly. In that you just double click and everything is there and easy to use". (Doctor 1: Hospital B)

Participants were requested to propose way of improving quality of services in Imaging departments and some of them recommended the purchase and installation of digital radiography equipment. The following excerpts serve as illustrations for the participants' recommendations:

".....thirdly this system of putting images on films I don't think it is really helping much. I think they should consider a software system". X-rays can easily get lost, the patient from casualty may arrive there without x-rays. That x-ray is so important, and you need to base decisions on it. Also, when it comes to filling, you find that if there was software it would be easy to retrieve all the x-rays because all the wards have computers". (Doctor 1: Hospital A).

".....second one I think would be a complete digital system". (Radiographer 3: Hospital C)

"The online form gives you a drop-down menu on all the different views you can select. The online version is even quicker than completing the paper one". (Doctor 4: Hospital A)

The participants from a hospital with full PACS running boasted on the advantages as per the following excerpts:

"Also we have a PACS system, so as soon as it is done, it goes straight to our PACS and the patient goes to the doctor to review the x-rays so there is no waiting for printing of film or printing of this and stuff". (Radiographer 1: Hospital B)

"..... thanks God we've got rid of the old way of working. So, the fact that we've got DR and CR, we are allowed to work faster. This reduces patient waiting

time dramatically. So, the turnover in terms of how many patients we see a day. We are able to provide that service quickly". (Radiographer 2: Hospital B)

6.4.4.2 In-service training

The participants were asked to share what is done to improve quality in their departments and participants from two hospitals mentioned performance of peer reviews. This is illustrated in the following excerpts:

"We also have a peer review programme. It is done weekly by one of our assistant directors, she collects films through the week, and we look at how it could have been improved. The department also look at the reject analysis from the CR system. If the problem for example is positioning, a radiographer who can explain it explains it to the rest of the staff". (Radiography Manager: Hospital A)

"We've got a very good in-service training in our department. Two weeks in a month we do peer reviews in our department. We take all the repeated x-rays and ask the question "what could have been done to avoid it from being rejected?" (Radiography Manager: Hospital D)

"Yes, every Wednesday we have peer reviews and we also have different in-services trainings". (Radiographer 1: Hospital D)

"For in-service training we do like peer reviews every week. So constantly learning what to do to benefit our patients". (Radiographer 3: Hospital D)

"So, when we have peer review, we discuss the quality of our work. And in that meeting if a radiographer is having an issue with a certain part for example a lateral shoulder, then we all gather in a room and we get one volunteer to explain how it's done. Like basically to refresh our memory and the ways we can make it easier. Especially when we have a difficult patient or a trauma patient so we just help each other to get different ways in which we can get better images". (Radiographer 3: Hospital D)

One of the participants felt that the in-service training conducted needed to be improved as illustrated in the excerpt below:

“A good in-service training and I think we lack in that. We need to be detailed with that. We need to have some sort of commitment to that and our standards will improve. If someone is new, they would not know how we do things here and they need to be trained. We need to go back to basics”. (Radiographer 2: Hospital A)

There was also a recommendation for in-service training on soft skills as well as resuscitation and first aid. Another participant recommended training on the proper use of Automatic Exposure Control (AEC) devices. The following excerpts illustrate these recommendations:

“You know we need a fund for training of radiographers. Let’s say courses of topics of interest. Upskilling of some sort because we do this every year with Performance management. We ask what we can do to improve your skills. We say these things and there is no money to do all these things. Then radiographers become despondent and that kind of thing. They only send like 80 people for courses like Supervisory skills, Mentorship for growth, Computer skills, Customer care, Labour Relations”. (Radiography Manager: Hospital B)

“The only other concern relates to trauma and emergency, sometimes we send very sick patients and I don’t think the department is well equipped to deal with those patients”. (Doctor 2: Hospital A)

“We have not done any in-service training for qualified as yet. Because we use the digital system, so training on using AEC (Automatic Exposure Control) devices would be helpful”. (Radiographer 3: Hospital B)

6.4.4.2.1 Shortage of radiologists

Coupled with unavailability of radiological reports as previously discussed, there were many participants who expressed a need for the employment of radiologists. These sentiments are expressed in the following excerpts:

“.....secondly they need more radiologists”. (Doctor 1: Hospital A)

“You see in the past we had registrars that used to do some of the radiology functions but that programme fell away so we are battling”. (Radiography Manager: Hospital A)

“The second thing is having radiologist cover after hours”. (Doctor 2: Hospital A)

“.....it’s been a couple of years since we received them due to shortage of radiologists”. (Doctor 4: Hospital A)

“And if there is only two radiologists who are working there, with this population now it’s going to be too much. The staff will be exhausted, and the patients will be irritable now because you cannot wait forever”. (Quality Assurance Manager: Hospital C)

“They need to hire more staff, especially specialists like radiologist because we don’t get reporting anymore because there are not enough radiologists”. (Doctor 4: Hospital A).

“The other thing they need to work on is the shortage of radiologists”. (Doctor 1: Hospital C)

“I feel we should have two or three radiologists, but we only have one”. (Radiographer 1: Hospital B)

“Also, the radiological services kind of cripple our quality. Unfortunately, patients don’t get a full service as they should”. (Radiographer 3: Hospital C)

“.....our radiologist, the only radiologist that we had is gone so now we are left with zero”. (Radiographer 1: Hospital C)

6.4.4.2.2 Shortage of radiographers

The participants were asked to share the factors affecting quality of services in their departments. It became clear that there were serious shortages for radiographers, and this impacted on the service delivery. None of the regional hospitals had a full complement of radiographers. The following excerpts illustrate the concerns raised by the participants:

“Obviously staffing, the turnaround times for patients can be improved”. (Quality Assurance Manager: Hospital A)

“I have three vacancies at the moment. So that is also impacting on the service delivery because we work with few staff. But we’ve two community service radiographers this year. Also, we have a lot of specialisations like CT, mammo and ultrasound so that takes a lot of our radiographers”. (Radiography Manager: Hospital D)

“For staffing we don’t have to get 100 staff, we just need to have 30 or 40 radiographers”. (Radiography Manager: Hospital D)

“First, they need to employ more radiographers especially after hours, you need to have at least more than one radiographer. After hours and even weekends they need more radiographers” (Doctor 1: Hospital A)

“Most of the time we don’t get radiographers available. We’ve been told that they are short staffed. The first thing is availability of radiographers when we need them in theatre so that we don’t have to make use of our interns to screen for us”. (Doctor 3: Hospital A)

“In High care we have patients who are bedridden immobile that need bedside x-ray. You request an x-ray on a patient that must be transferred from High care to ICU, the patient will wait for 24 hours for the x-ray to be done. Sometimes that patient might go to ICU without any confirmation. You insert a tube and ask

for an x-ray to see if the tube is in the correct position and that is usually urgent as you need to take a decision". (Doctor 2: Hospital C)

"They must hire more members. I think they have shortage of staff, sometimes you request for a BSU and you discover there is only one or two people working". (Doctor 2: Hospital C)

"I think it is shortage of radiographers because one person does the whole hospital at times". (Doctor 1: Hospital C)

".....but in terms of radiographers we are very short staffed and that is what negatively affect our quality in this department because the patients would wait shorter if we had more staff. It is also more taxing on us as radiographers". (Radiographer 1: Hospital B)

".....there is a huge staff shortage; so we are a little bit stretched and overworked".....if there is no clerk you are the clerk, you are the porter you are the cleaner, so as much as it would be nice to get other axillary staff in the x-ray department, more radiographers are needed". (Radiographer 3: Hospital B)

6.4.4.3 Workplace review

6.4.4.3.1 Management of after-hour services

Some of the participants were concerned about poor service delivery to patients after hours. In some departments, there were very few staff members working after hours and staff also complained that they worked long hours. Long shifts also impacted on the family life of those affected. The following excerpts illustrate the issues raised:

"I would say hours for night duty and that. We specifically in this department work one radiographer per night because we don't have the staff. They looked

at our stats and they said we can't get more because we don't make the numbers but still. If we had more staff, we would probably work an eight-hour shift. Change roster situation to facilitate more people on days and more people on night. That would take off lots of workload. And when staff is happy, everybody is happy and work improves, there is no or less problems". (Radiographer 3: Hospital B)

6.4.4.3.2 Workload

Whilst commenting on the factors affecting quality of service in imaging departments, the participants expressed their concerns about high workload in the imaging departments. Some of the reasons were high workload were blurred divisions between various levels of healthcare delivery, staff shortages, equipment faults, high patient volumes and unnecessary imaging requests. These expressions are illustrated in the following excerpts:

"This is a regional hospital, but we do tertiary services". (Radiography Manager: Hospital A)

"We don't have enough radiographers; we don't have enough x-ray units. That impacts obviously on the waiting time. We do plus minus 300 patients each day. So, in terms of the quality of services in the department, yes, we are providing a quality service but it comes with costs". (Radiography Manager: Hospital D)

"The workload is very high especially in our department. Our night shift can be very busy with about two radiographers on duty. We do 400 to 500 examinations a day". (Radiography Manager: Hospital D)

".....because the x-ray department services the entire hospital after hours so there can be quite substantial delays". (Doctor 2: Hospital A)

"The problem is there are high patient volumes and many patients that are not supposed to go for x-rays do go for x-rays especially after hours. That unfortunately leads to an increased overload and strain on one or two radiographers that are available after hours". (Doctor 1: Hospital D)

“And then there must be compassion for fellow healthcare workers. We must understand that after hours and weekends there is skeletal staff so we can’t go and order chronic conditions because one or two people that are there get overworked. All because the general population cannot understand what emergency is and what is not emergency”. (Doctor 1: Hospital D)

“We have a very heavy workload in this department and not enough staff and the equipment fails us”. (Radiographer 1: Hospital A)

“.....you’ve got ten patients to do and you have a short time to do all of them. You are working alone so indirectly it’s your resources and you tend to rush because you want to get through the work so you don’t do the patients the quality they deserve in doing your work properly you know you tend to rush”. (Radiographer 2: Hospital A)

“Say after hours, sometimes it’s very busy. So, there is a big large workload that takes a toll on the machines as well you know. Machines overheat that is the reason they break down. So, if the machines break down, there is no way we can offer a high-quality service”. (Radiographer 3: Hospital A)

“..... you literally have to go and wheel the trolley from trauma into the x-ray room. Clerk the patient, x-ray them and then take the patient back. And there is only two people on night shift, the other one is probably doing the BSU or in theatre”. (Radiographer 4: Hospital A)

“It is one CR reader and we are the busiest hospital. Whereas if you compare us to other hospitals, they have two CR readers without the workload. There are times when the machine is down and there is nothing we can do. We process what we can”. (Radiographer 1: Hospital C)

“.....firstly the number of patients that come to this hospital alone, it’s a huge influx sometimes it makes them wait longer for getting the service”. (Radiographer 2: Hospital C)

“If there is an accident all the patients get sent to the x-ray department because everybody wants to claim from the Road Accident Fund and our patients here feel that they are entitled to have an x-ray service. So, they tell the doctors that they want an x-rays and the doctors send the patient for x-ray even when they don’t need that x-ray clinically but it’s because of the aggression you get from the community. So, we get a lot of unnecessary x-rays that come in after hours. And we just got to do it.” (Radiographer 3: Hospital C)

“I think that the quality sometimes can be compromised in terms of the number of patients that the hospital is seeing. We have an increased number of patients; we do not have proper equipment”. (Radiographer 2: Hospital D)

“You see this hospital is extremely busy and we have lots of patients because we don’t have a drainage system here, so we see patients from all over. So it’s a little bit more than the other institutions out there”. (Radiographer 3: Hospital D)

6.5 CHAPTER SUMMARY

Qualitative data was presented in this chapter. Themes and sub-themes were also identified and presented. Equipment related challenges and staff shortages were the main challenges affecting quality of service delivery in imaging departments within the eThekweni District. In Chapter 7, mixing of quantitative and qualitative data will be presented.

CHAPTER 7: MIXING OF QUANTITATIVE AND QUALITATIVE DATA

7.1 INTRODUCTION

Quantitative and qualitative results were presented in chapters five and six respectively and in this chapter the two sets of results are merged. This is done to create a broader understanding of both sets of results. The strategy used was that of identifying areas of contradictions and similarities among the two sets. A discussion of quantitative results followed by that of corresponding qualitative results was conducted. The qualitative results were used to corroborate or illustrate the descriptive quantitative results. This was done in the order of the research questions and according to themes. The research questions involving both quantitative and qualitative data collection were:

- What are the main challenges associated with quality in imaging departments?
- To what extent are the patients satisfied with the service delivery in imaging departments?

7.2 RESEARCH QUESTION 1: WHAT ARE THE MAIN CHALLENGES ASSOCIATED WITH QUALITY IN IMAGING DEPARTMENTS?

The quantitative results revealed that whilst the reject rate was as high as at 16% for some hospitals in some months, the average remained at about 11%. The qualitative results corroborated the quantitative findings. Another participant believed the department had a much lower reject rate. The statistics for the reject analysis in the same department actually revealed that the reject rate was indeed 10%. Both qualitative and quantitative findings showed that the departments need to take some steps in improving the reject rates.

7.3 RESEARCH QUESTION 2: TO WHAT EXTENT ARE THE PATIENTS SATISFIED WITH THE SERVICE DELIVERY IN IMAGING DEPARTMENTS?

7.3.1 Friendliness of the receptionists

The results of the quantitative study revealed that the majority of the participants agreed that the receptionists were friendly. The quantitative results were refuted by the qualitative results as the participants expressed the view that there was lack of politeness and service with a smile on the side of the receptionists.

7.3.2 Time spent in the waiting area

During the quantitative data collection, the majority of the participants expressed their satisfaction with the length of time they spent in the reception area. However, there was less agreement amongst the participants regarding this statement ($M = 4.67$). The qualitative results contradicted quantitative findings.

Contrasting views were expressed in the results of the qualitative strand. The qualitative results revealed that 14% ($n=4$) of the participants disagreed with the quantitative results in addition to the 28% ($n=77$) in the quantitative strand who disagreed that the waiting time in the reception area was acceptable. In this regard quantitative data was positively skewed as sufficient evidence indicating that the waiting times were unacceptably long emerged during qualitative data collection. The participants attributed long waiting times to staff shortages. On the other hand, the qualitative results further corroborated the quantitative findings as they revealed that 18% ($n=5$) of the participants agreed that waiting times were reasonable short. Most of the participants expressing shortness of the waiting times were from the hospital with fully digital equipment and a sound maintenance plan for equipment. In addition, the length of time viewed to be acceptable varied from department to another. For example, in the fully digital department ten minutes was considered a long waiting time whilst in other three departments patients could wait up to about four hours. In addition, there were instances where patients would wait for longer than the average of four hours.

7.3.3 The professionalism / friendliness of staff

The results from the quantitative strand showed that there was a strong agreement among participants that radiographers and radiologists displayed characteristics of professionalism and friendliness. The results revealed that the majority of the participants agreed with this item. There was no sufficient evidence to corroborate this statement from the qualitative data and very few of the participants refuted the statement. The participant believed that there was lack of patient care and professionalism.

7.3.4 Explanation of the examination/ procedure

The quantitative findings revealed that the majority of the participants agreed that examinations/procedures were explained. The qualitative results corroborated the quantitative results in that the participants explained that time was taken to explain the procedure to the patients.

7.3.5 Cleanliness of the imaging department

The quantitative results on the statement assessing the cleanliness of the Imaging departments showed that the majority of the participants were satisfied with the cleanliness of the Imaging departments in regional hospitals within the eThekweni District. The quantitative results were corroborated by the qualitative results and the participants expressed the importance of the cleanliness of the department. The participants went on to state that they would clean themselves when the cleaners were unavailable to do so.

7.3.6 Safety in the reception area

The quantitative results showed that there was strong agreement amongst the participants regarding their safety in the reception area. Further to this, the quantitative results revealed that the majority of the participants were satisfied with their safety in the reception area. The qualitative results corroborated these quantitative results as the interviewed participants expressed that patients are provided with a safe space thus resulting in happy patients.

7.3.7 Impression with the staff

The quantitative results revealed that the majority of the participants agreed that in overall, they were impressed with staff. On the other hand, a very small minority of the participants disagreed with this statement. The qualitative results indicated an insignificant contrast to the quantitative results. The participant further alluded that there were few complaints regarding staff attitude.

7.3.8 Patient care

The quantitative results showed that the majority of the participants agreed that staff are caring and very few of the participant disagreed with this statement. The qualitative results refuted the quantitative results as 10.7% (n=3) of the participants expressed lack of patient care in the Imaging departments. There was sufficient evidence revealed during qualitative data collection that the quantitative data on patient care was positively skewed.

The majority of the participants who commented on patient care (80%, n=8) during qualitative data collection fervently expressed their dissatisfaction about patient care in the imaging departments. It was therefore clear that although most patients were satisfied with the level of patient care, the radiographers were convinced that there was a room for improvement in this regard.

7.3.9 Comfort of air temperature in imaging department

The quantitative results showed that the majority of the participants agreed that the air temperature was comfortable. Corroboration of the quantitative results using qualitative results showed that there were challenges with air conditioners in 50% (n=2) of the hospitals in which data was collected. The researcher concluded that whilst air-conditioners were in a working order in two of the regional hospitals, and whilst patients were not mainly concerned about functioning of the air-conditioners, there were indeed challenges with air-conditioners in some hospitals.

7.3.10 Comfort of the waiting area

The quantitative results showed that the majority of the participants disagreed that the waiting area was comfortable. There was a significant disagreement that the participants were satisfied with the overall comfort of the waiting area. The level of disagreement was more among males and outpatients than it was among females and inpatients. The qualitative results corroborated quantitative findings and in 50% (n=2) of the hospitals all patients used a single waiting area as there were no separate units of the departments. A good monitoring system was however used in another hospital as a triage nurse was monitoring patient conditions and patients were prioritised according to their degree of sickness.

7.3.11 Cleanliness of the linen

The quantitative results revealed that the majority of the participants agreed that they were satisfied with cleanliness of the linen. There was strong sense of agreement among participants regarding their satisfaction with cleanliness of the linen. The qualitative results corroborated the quantitative results on cleanliness of the linen and the participants stated that they would ensure the linen is clean even in the absence of the cleaners.

7.3.12 Comfort of the x-ray bed

The quantitative results showed that the majority of the participants agreed that the x-ray beds were comfortable. The qualitative results corroborated the quantitative results and only 3.6% (n=1) of the participants expressed their dissatisfaction with the x-ray bed. In fact, the challenge expressed was more a technical than having to do with the actual comfort.

7.3.13 Satisfaction with the service delivery in Imaging departments

During the quantitative data collection, the majority of the participants (65.8%, n=181) were impressed with service delivery in the Diagnostic Imaging departments. Furthermore, there was strong agreement amongst the participants on this regard (M=5.40, SD=1.058). On the other hand, during

collection of qualitative data the participants expressed their concerns about the quality of service delivery in the departments. The participants alluded that there were too many factors negatively impacting on service delivery. The two sets of data thus contradicted each other with regards to service delivery.

7.3.14 Provision of radiation protection

The quantitative results showed that the majority of the participants agreed that they were provided with radiation protective apparel whilst 14.3% disagreed. There was a high level of agreement among participants on this statement and the level of agreement was more among females than it was among male participants. The qualitative results corroborated quantitative results to some degree as 66.6% (n=2) of the participants who commented on provision of radiation protection were satisfied with provision of radiation protection.

7.4 THEME 2: INADEQUACY OF CLINICAL PROVISIONS

The researcher also merged qualitative and quantitative data using themes and noted contradictions relating to communication between patients and staff as explained below.

7.4.1 Communication between patients and staff

The quantitative results showed that the majority of the participants agreed that they were able to communicate with all staff. There was disagreement between qualitative and quantitative findings as the qualitative findings revealed that 71.4 (n=5) of the participants who commented on communication expressed the view that there were elements of inadequacy regarding communication between patients and staff. It became quite clear from both sets of results that there are areas in which communication between patients and staff needed to be improved.

7.5 CHAPTER SUMMARY

In this chapter, mixing of quantitative and qualitative data was done. Research questions and themes were used to shape the discussion. Similarities and contradictions were identified and reported. The strategy used for merging of the two sets of results was the discussion as the researcher found this strategy more suitable in this study. In Chapter 8, the discussion of the findings will be presented.

CHAPTER 8: DISCUSSION OF THE FINDINGS

8.1 INTRODUCTION

In this chapter both quantitative and qualitative findings are discussed. The discussion also incorporates the mixing of the two strands. The discussion is structured in order of the research objectives and themes whilst keeping within the theoretical framework presented in Chapter 3. The discussion therefore is based on both the conceptual framework and the study objectives. Following a discussion with reference to the conceptual framework, the researcher moved on to discuss findings of the survey and the image reject analysis and further presented a discussion on how the various groups of participants in the qualitative strand of data collection defined quality of imaging services. In an attempt to ensure integration of the conceptual framework in the current study as stated by Grant and Osanloo (2016: 16), the primary researcher discusses the study findings based on the conceptual framework. This part of the discussion was merely to ensure that the study is properly aligned to the conceptual framework. The last section of this chapter deals with issues of quality as presented by the participants during collection of qualitative data. Mixing of quantitative and qualitative findings is used in sections where this was deemed necessary. All these areas are discussed in relation to available literature on each of them with the researcher adding his voice as he navigates through the discussion. In doing so the researcher is careful not to influence the findings as he himself is a radiographer with many years of clinical and academic experience. Finally, all the results were discussed with the view to ensure that all research questions are answered.

8.2 DISCUSSION OF STUDY FINDINGS IN RELATION TO THE CONCEPTUAL FRAMEWORK

The conceptual framework guiding the current study described the role of imaging services in a clinical setup. One of the main focusses of the conceptual framework was to explain that the imaging process diagnoses the patient by revealing the type, the size, the extent and other features of a disease (Larson and Langlotz 2017: 993) and as a result the quality and promptness of the diagnostic information is critical. In compliance with this aspect of the conceptual framework, one of the objectives in the current study was to assess the factors influencing quality of service delivery in the imaging services. This objective was achieved by conducting in-depth one on one interviews with doctors, radiographers, Radiography Managers and hospital Quality Assurance Managers. All participants were asked to define their understanding of quality of imaging services and their responses were aligned to the conceptual framework as they alluded that doctors depended in imaging service to adequately manage various patient conditions. However, there were some dissatisfactions amongst doctors regarding long waiting times and unavailability of some imaging modalities.

The conceptual framework further explained that the radiography team has a responsibility to interrogate the adequacy of the requested modality and examination considering the clinical history provided in the request form. On the other hand, the radiology team lead by the radiologist should be able to inform on the best modality and protocols necessary for diagnosis of the suspected disease/condition (Larson and Langlotz 2017: 994). The communication between the patient and a member of the radiology team thus becomes important in ensuring that the information provided by the patient is adequate and accurately understood by members of the imaging team. Further to this, a study conducted by Siewert, Brook, Hochman and Eisenberg (2016: 575) to establish the impact of communication errors on patient care, customer satisfaction and efficiency of work processes found that 14% of errors were related to ordering of examinations.

The findings of the current study revealed that there was a level of dissatisfaction amongst both radiographers and doctors relating to communication between the two stakeholders. Doctors were concerned that radiographers at times would take images of unrequested body parts. On the other hand, radiographers were concerned about the patients presenting to Imaging departments with inadequate requests by the doctors as at times they found that the part or side requested for imaging was not the affected side. This would emanate from the radiographer patient information prior to imaging as is the routine for radiographers. This is a necessary function as radiographers have to offer a radiation safe service to patients (Makanjee, Berg and Hoffmann 2015: 11). However, the radiographers have to communicate constantly with requesting doctors whilst practicing such safety measures and this is referred to by Makanjee, Berg and Hoffmann (2015: 12) as the “*provider-provider interaction*”.

In assessing the communication between the imaging team and the patients, the primary researcher in the current study conducted a patient satisfaction survey. The survey was completed by 375 outpatients and in-patients in the regional hospitals in the eThekweni District. The results of this survey found that patients were satisfied with most aspects in the imaging departments. However, the patient waiting times scored the list. This was quite concerning as in all regional hospitals surveyed there was no segregation of patients with infectious diseases to the rest of the patients and it is known that contacts between undetected tuberculosis patients and those tuberculosis free may result in further infections (Bojovic, Genet and Sabatier 2018: 2).

Whilst explaining the concept of quality in imaging departments, the conceptual concept further alluded that the quality control (QC) of equipment should be performed as per specifications of the controlling body. It is also known that in developing countries like South Africa, QC of equipment is often neglected and in some hospitals assessment of equipment quality is only conducted when preparing for inspections for licencing purposes (Delis *et al.* 2017: 105). In South Africa, the quality of equipment is regulated through the SAHPRA Board

of the National Department of Health. This board specifies tests to be undertaken on a regular basis (South Africa. Department of Health 2009: 45).

Interviews with radiographers and Radiography Managers in the current study showed that performance of QC tests was done at different levels within the district. In some hospitals, radiographers were allocated to perform QC tests but lacked the time to comply due to high patient volumes. There were hospitals, however in which the QC tests were regularly performed. Radiography Managers should allocate time for radiographers to perform QC tests as this is a required support needed by radiographers to be diligent in this very important task (Willemse, Williams and Grobler 2020: e3).

The conceptual framework also directs various methods to be used in monitoring quality in an Imaging department. These include a documented set of protocols agreed by all stakeholders as well as regular image reject analysis (Delis *et al.* 2017: 106). In addition, Ramlal and (2013: 252) and Joshi (2009: 109) provide quantifiable quality measures as results of local satisfaction rates (patients and doctors), number of complaints received from patients, number of complaints received from clinicians, response time in emergency cases after hours, time taken in generating and communicating the reports, instances of breakdown, repairs and downtime of equipment and turnaround times for different examinations and patients. Radiographer participants, in the current study, complained that there were no protocols to guide performance of imaging services.

All these aspects of the conceptual framework were assessed in the current study to ensure compliance of the regional hospitals in the eThekweni District. Amongst these was the performance of an image reject analysis which revealed that in one of the hospitals the image reject rate analysis was not performed. The image rejection rates were found to be high in some of the hospitals and further discussion on this is provided later on in this chapter. With regards to the number of complaints received from recipients of the imaging services, interviews were held with Quality Assurance Managers and Radiography

Managers and both groups were not aware of any complaints relating to the imaging team. Although the doctors were not satisfied with some of the aspects, no formal complaints were recorded in the Imaging departments. During interviews doctors stated their dissatisfaction with turnaround times, particularly after hours as there were fewer Imaging department staff. Further to this, in some hospitals there were no radiologists at all and in some a severe shortage of radiologists was experienced.

With reference to equipment, the participants revealed that most factors regarding quality of imaging services were caused by the lack of adequate equipment, faulty equipment and poor maintenance of equipment. In some departments, some modalities were not being performed and patients had to be transported to other facilities. Whilst the results of this study indicate a poor state of the equipment in the studied district, a study by Kabongo, Nel and Pitcher (2015: 3) revealed that KwaZulu-Natal was one of the provinces in which there was a full spectrum of equipment in both private and public sector. The study further revealed that the South African public sector was very under resourced in terms of the number of equipment pieces per a million population.

The second broad aspect of the conceptual framework was the NCS. The NCS have been adopted by the South African Department of Health to improve healthcare services in all health establishments. Purposes of the NCS are explained in the document containing the standards (South Africa. Department of Health 2011: 12). The NCS are divided into seven domains and each domain is further broken down into several subdomains. Further to the subdomains, there is a standard measured by certain criteria. The domains are Patient Rights, Patient Safety, Clinical Governance, Clinical support services, Public Health, Leadership and cooperative government, Operational Management and Facilities and Infrastructure. Amongst the Clinical Support Services subdomains, the current study was focused on the sub-domain referred to as diagnostic services. This sub-standard is set to assess the availability of imaging services and their ability to provide good quality reports or results within

agreed timescales, and protection of staff from unintentional radiation exposure (South Africa. Department of Health 2011: 8).

The current study set to assess the attitudes and knowledge of radiographers regarding the tool used during inspections. The results revealed that the knowledge of radiographers regarding the NCS was very poor. Radiographers could not name the domains of the NCS and stated that they were not trained on the standards. A similar finding was observed in a study by Chellan and Sibiya (2018): On the other hand, the Radiography Managers were better informed as they were apparently involved during the inspections. The Radiography Managers further mentioned that the process of inspections required to be changed to align the requirements to the latest development in the field. The deficiencies emerging from this study are an indication that a comprehensive document on quality standards for the Imaging Departments needs to be developed.

8.3 DEFINING QUALITY OF IMAGING SERVICES

8.3.1 Definition by Quality Assurance Managers

In a healthcare setting with multiple professions, quality of care can be defined from different points of view. During data collection of the current study, Quality Assurance Managers defined the quality of imaging services as accessibility to a range of radiographic examinations, availability of porters for sound transportation of patients, absence of complications/reactions to contrast media, adequate turnaround times/waiting time and good image quality. According to the Donabedian model (Harvey *et al* 2016: 116), all of these aspects should have seven principal attributes being efficacy, effectiveness, efficiency, optimality, acceptability, equity and legitimacy.

8.3.2 Definition by Radiography Managers

Definitions of imaging quality according to the Radiography Managers in the current study included ensuring provision of best services, cleanliness of the department, patient waiting times, patient satisfaction, performance of quality

control tests, maintenance of Health and Safety and staff development. All aspects raised by Radiography Managers talk to the improvement of services to both internal (doctors and other users of services) and external (patients) clients as explained in Joshi (2009: 101). It is however not clear how much training has been rendered to Radiography Managers to ensure that their leadership skills are sharpened. A qualitative study conducted in New Zealand by McKenna and Richardson (2003: 80) found that nurses were promoted to management positions without relevant training. In another effort to explore the rise of radiographers into management positions, Thomson and Henwood (2016: 92) revealed that Radiography Managers lacked the support to be trained, were stressed and experienced ambiguity of roles. Some of the Radiography Managers in the eThekweni District shared their responsibilities between clinical and management roles, thus making it difficult for them to focus on pushing the agenda of ideal departments they wished to build as per their understanding of quality.

8.3.3 Definition by doctors

In their definition of the quality of imaging services, the doctors were mostly concerned with availability of services, waiting times and image quality. Joshi (2009: 102) identifies doctors as the internal clients of an Imaging department, thus adequate steps to be taken to satisfy them. The expectations of doctors in the current study is in keeping with the role of imaging services in the clinical process which is explained as that of providing a working diagnosis (Larson and Langlotz 2017: 992). In addition, whilst exploring factors affecting quality of healthcare services, Mosadeghrad (2014: 84) found that staff shortages and old equipment resulted in delays in service delivery and were stressors to doctors. It is reasonable for doctors to expect that once a request form has been received by the Imaging department, a quality service will be delivered to doctors and patients (Makanjee, Bergh and Hoffmann: 2015: 11). Imaging departments should therefore collect feedback from doctors as their customers, analyse feedback and improve services accordingly (Kruskal *et al.* 2011: 1500). In addition, it should always be remembered that behind the doctor is a patient and South Africa has changed legislation to afford patients the status of

consumers (Rowe and Moodley 2013: 3) thus opening the government to litigations.

8.3.4 Definition by radiographers

In their definition of the quality of imaging services, the radiographers in the current study expressed most of the statements as mentioned by the doctors, Radiography Managers and Quality Assurance Managers. Radiographers were mainly concerned with turnaround times, equipment and patient care. Radiographers also expressed the view that high workload resulted in poor quality. With regard to turnaround times the concerns expressed by radiographers were similar to those received from patients during the quantitative strand of the current study and are an indication that there is a need to implement new service delivery initiative as found in a systematic review study by Olisemeke, Hemming and Girling (2014: 755). This review observed that various strategies were used by imaging departments in many parts of the world to improve service delivery to patients and these included extended scope of practice which focused on radiographers reporting on images. The review also revealed outsources of services and actually proved that turnaround times improved when services were outsourced.

8.4 PATIENT SATISFACTION WITH SERVICE DELIVERY

8.4.1 Waiting times

The quantitative data in the current study revealed that the majority of the participants were satisfied with the length of time they spent waiting to go into the x-ray rooms. However, mixing of the quantitative and qualitative strands showed that the waiting times were at an average of four hours. The time taken to enter the examination rooms in this study was much higher than that recorded in an Ethiopian study where the longest time taken to enter the examination room was two hours (Mulisa, Tessema and Merga 2017: 6). On the contrary the majority of the participants in a mixed methods study by Gawugah (2016: 120) expressed that the waiting times were very long. It is important for the authorities to do everything possible to reduce the waiting

times as waiting times negatively affect patient management (Yimer, Bjune and Holm-Hansen 2014: 4; Cai et al).

Long waiting times can be attributed to a number of reasons and in the current study the participants expressed that these were due to staff shortages and equipment faults. This finding was in line with findings by Ugwuanyi, Chiegwu, Eze and Okoli (2017: 599) which found that long waiting times were due to staff shortages, equipment faults and non-reporting by radiographers. Both reasons for long waiting times revealed in this study have affected quality of imaging services in the eThekweni District in several ways. This study further showed that waiting times were much shorter in the regional hospital with full digital equipment and a sound equipment maintenance plan. This finding is in line with that of Olisemeke, Chen, Hemming and Girling (2014: 756) who found that for most studies the PACS improved patient waiting time. Another study performed at primary healthcare level within the KwaZulu-Natal province (Sokhela, Sibiya and Gwele 2016: 52) found that workload was too high and radiographers in the current study were also concerned about high workload and staff shortages.

8.4.2 Cleanliness in imaging departments

Cleanliness in any section of a clinical facility gives assurance that the area is free of pathogens. The quantitative results in the current study showed that the majority of the participants were satisfied with cleanliness and safety of the four X-Ray departments in which data was collected. The department is compelled to take steps in ensuring that patient surroundings are cleaned (European Society of Radiology 2019: 7). Loveday *et al.* (2014: S64) further warn that due to mixing of patients diagnosed with infections and those that are undiagnosed, all surfaces should be cleaned rigorously at periodic intervals. It was worth noting to hear during collection of qualitative data that radiographers were willing to clean themselves when cleaners were absent from duty. Cleaning in healthcare settings should not only be about removing dirty particles from the surfaces but more to prevent Healthcare Associated Infections (Hall *et al.* 2016: 2) by eradicating the number of microbes present on a surface (Dancer 2004: 11).

8.4.3 Cleanliness of the reception area

All patients visiting the Imaging departments go through the reception area and the cleanliness of this section is therefore of utmost importance as cross infections can occur very easy. The results of the current student showed that the majority of the participants were satisfied with cleanliness of the waiting area. In addition, a study by Gawugah (2016: 122) revealed similar results as he pointed out that majority of the participants were satisfied with cleanliness of the waiting area. On the other hand, a study by Abdosh (2006: 1) found that general cleanliness of the facility obtained the lowest score. The findings of this study were refuted by Frichi, Jawab and Boutahari (2020: 313) who found that urgent patients experienced lack of resources and services including availability of chairs and cleanliness.

8.4.4 Cleanliness of linen

Patients undergoing imaging examinations often have to remove their clothing and put on hospital gowns. In addition, some of the examinations have to be undertaken with patients lying down on an examination table with sheets and pillows covered by pillowcases. It is worth noting that the majority of the participants in this study were satisfied with the cleanliness of the linen. Radiographers further expressed during collection of qualitative findings that they would ensure that linen is clean even if the cleaners were not available. An infectious disease policy is therefore necessary in each healthcare facility to ensure curbing of infections (Malavaud, Joffre, Auriol and Darres 2012: 820). Lastly, the state of hotel services in a hospital including provision of clean linen to patients positively affects the satisfaction of patients (Sevin 2018; Suess and Mody 2018).

8.4.5 Radiation protection

The South African society like everywhere else in world is increasingly exposed to ionising radiation from various sources like radon radiation from the stones, flight related exposures (McLean *et al.* 2017: 2), radiation diagnostic procedures (Averbeck *et al.* 2020, Zewdeneh, Teferi, and Admassie 2008;

Shabstani Monfared, Abdi, and Saber Moghadam 2007). On the other hand, exposure to radiation can have negative effects to human tissue and radiographers should do their best to protect patients from radiation exposure. An overwhelming majority of the participants during collection of both quantitative and qualitative data agreed that they were satisfied with provision of radiation protection apparel. This was worth noting as many patients in South African hospitals receive repeated x-ray examinations (Beyer and Diedericks 2010: 25) thus adding the radiation load to their tissues. The SAHPRA Directorate of the Department of Health in South Africa advises that the application of gonadal protection to male and female patients during x-ray examinations can reduce radiation dose by 95% and 50% respectively (South Africa. Department of Health 2009: 2).

8.4.6 Friendliness of receptionists

Friendliness of staff in healthcare facilities has been identified as determinant of satisfaction in many studies (Mulisa, Tessema and Merga 2017; Gawugah 2016; Beyer and Diedericks 2010). Friendliness is very important as it makes patients to feel they are welcomed to the facility. In Imaging patients do not really know about the quality and diagnostic images radiographers might take, but they always remember how they are treated. Further to this, receptionists are the front of an Imaging department and as such will interact with patients before everyone else, so the impressions experienced in reception areas usually last longer.

The results of the quantitative study revealed that the majority of the participants agreed that the receptionists were friendly whilst the participants in the qualitative component of the study expressed that the receptionists were unfriendly. These results were in keeping with findings of Mulisa, Tessema and Merga (2017: 4) who revealed that the majority of the participants in their study were satisfied with the manner in which the staff treated them, whereas almost 25% of the participants were dissatisfied with friendliness of staff.

8.4.7 Professionalism/friendliness of radiographers

Patients expect radiographers to show professionalism, respect and friendliness from the time they call them into the examination room. Moodley *et al* (2015: 4) explains that the standards of care improve when professionalism is inculcated into healthcare professionals. It was pleasing to note that the current study revealed that there was a strong agreement among the patient that radiographers were friendly and professional. The professional conduct by radiographers was also noted in a study by Gawugah (2016: 122) in which the majority of radiographers were found to be more professional in dealing with patients. In South Africa, the public is protected from the poor conduct of radiographers and other healthcare professionals by the HPSCA (South Africa. Department of Health 2012: 12). The HPCSA defines a profession as “*dedication, promise or commitment publicly made*” (HPCSA 2014: i).

8.4.8 Overall impression of patients with staff

Most of the participants in both quantitative and qualitative strands of the current study expressed their satisfaction with staff in the Imaging departments. The qualitative strand of the current study afforded the primary researcher an opportunity to probe this further. Radiographers expressed that they were kind and helpful to patients regardless of the conditions they worked under. Mosadeghrad (2014: 81) and Winterberg (2001: 352) add that healthcare providers should develop healthy relations with their patients through personality characteristics such as respect, willingness to help, reliability, intelligence and confidence. Bettye in Adler and Carlton (2007: 142) further explains the importance of effective interactions between patients and radiographers to improve the quality of images through patient cooperation. The radiographer must impress the patient through the professional dress code, clear communication (and instructions), respect and their actions throughout the examination. It is envisaged that the managers in departments where there are staff related complaints resolve these in an amicable way.

8.4.9 Patient care

Patient care in radiography is influenced by a number of aspects including patient dignity, patient waiting times and many others. In the current study, the quantitative results showed that most of the participants (patients) agreed that staff are caring. However, during collection of qualitative results, the quantitative results were refuted as some participants (radiographers) expressed lack of patient care in the imaging departments. This disagreement of opinions between radiographers and patients is a clear indication that whilst radiographers pride themselves on beautiful quality images and application of radiation protection, what matters more to patients is how they are treated whilst they are in the unfamiliar environment they find themselves in (Bettye in Adler and Carlton 2007: 143).

It is therefore, clear from the results of this study that the government needs to provide a range of resources in order to improve patient care in the imaging departments (Sari, Indasah and Suprpto 2020: 409). Patient satisfaction is an important factor in ensuring quality of an imaging departments (Cirnu 2017: 57) and planning and delivery of care should be rendered with the patient in mind as the recipient of such services (Abushab *et al.* 2017: 44). The participants alluded to aspects such as long waiting times (due to high workload and staff shortages coupled with equipment challenges), shortage of radiation protection apparel, and other aspects as areas requiring urgent attention of hospital management and the state.

8.4.10 Overall satisfaction of patients with service delivery

Most of the participants in the current study were satisfied with service delivery in Imaging departments in regional hospitals in the eThekweni District. The results of the current study are in line with studies conducted in Ethiopia and South Africa in which similar satisfaction rates were revealed. However, in another Ethiopian study investigating satisfaction patients with hospital services (Abdosh 2006: 201) the results showed less satisfaction (54.1%). It was also noted that areas resulting to dissatisfaction of patients with services related to provision of medicine. The managers within the hospitals need to guard against

non-functioning equipment as this may results in patients being dissatisfied with general services of the entire hospital as observed in a study by Frichi, Jawab and Boutahari (2020: 305). A study comparing patient satisfaction between public and private hospitals (Ochocma, Eze and Eze 2016: 435) indicated the courtesy and attention of radiographers in both institutions were similar but the appearance of the buildings and equipment were better in the private hospitals. Although the study was conducted in Nigeria, another African developing country, the circumstances are similar, and the government of South Africa needs to take recommended actions to improve the situation in South African hospitals.

8.4.11 Comfort of air temperature

As visitors to the imaging department, patients do not only need the best imaging services but comfort as well. The quantitative findings in the current study showed that the patients were satisfied with comfort of the air temperature whilst radiographers in some hospitals (qualitative finding) were dissatisfied. The results in this study regarding satisfaction of patients with air temperature are similar to those in other studies elsewhere in the globe (Abushab *et al* 2017 and Mulisa, Tessema and Merga 2017). The similarities in patient satisfaction with air temperature is probably due to the fact that imaging departments are required to have functional air conditioners to ensure smooth functioning of equipment. However, a paper on strategies used to reduce COVID-19 infections in a Chinese (Whuhan) imaging department revealed that central air conditioners were switched off to prevent shared contamination of the air (Zhao *et al* 2020: 3). All Imaging departments in which data were collected are situated almost in the centre of hospital buildings for their proximity to various sections of the hospital. For this reason, Imaging departments rely more on air conditioners for reasonable air temperatures.

8.4.12 Comfort of waiting areas

Comfort can be observed in the chairs they sit on whilst waiting, provision of appealing pictures on walls, waiting rooms with television (or radio), reading

magazines etc. The items on overall comfort of the waiting area received the least score as 65% of the patients were dissatisfied with this aspect. In addition, there was a significant disagreement regarding this item as the average agreement score was below the central point of the Likert scale (3.5). The results in this study were similar to those in other studies (Mulisa, Tessema and Merga 2017: 5 and Ochonma, Eze and Eze 2016: 435) who found that patients were dissatisfied with appearance of the facilities. Although these studies were quantitative and could not uncover the actual concerns for this dissatisfaction, it is speculated that patient comfort was included in this category. It must be remembered that the comfort of patients is one of the key role players when examining patient satisfaction (Sari, Indasah and Suprpto 2020: 441).

Another finding of the current study was that into of the regional hospitals in which data was collected, all patients used a single waiting room regardless of their illness or condition. Although this may be protected by explanations such as avoiding discrimination/stigmatisation amongst patients, the emergence of highly infective diseases like the coronavirus disease has forced hospitals to separate patients suspected of infections to those that are asymptomatic or not suffering from any infectious disease (Zhao *et al* 2020: 5). The unavailability of such arrangements could result in discomfort for some of the patients thus resulting in lower score for provision of comfort in the waiting area.

8.4.13 Comfort of the x-ray table

The X-ray table (often referred to as the X-ray couch or X-ray bed) is designed to support the patient when images have to be taken in any recumbent position. To support varying sizes and patient masses the table is built to be quite strong, radiolucent and resistant to damage (Burbridge and Mah 2017: 54). Because the X-ray table is designed to be hard, it is important for the radiographer to ensure that there is a mattress on the table before the patient climbs on it. With this background in mind, it was quite pleasing to note during collection of quantitative data in the current study that the majority of the patients were satisfied with comfort of the X-ray table. A study by Beyer and Diedericks (2010: 25) revealed that the majority of radiographers were empathetic to patients and

patients received enough support from the radiographers. Both the current study and the one by Beyer and Diedericks (2010) are South African studies and are pleased to note, as in diagnostic imaging the radiographer uses highly technical equipment to obtain images of the human body (Munn and Jordan 2011: 322). Thus, tends to give more focus to production of the image rather than taking care of the patient.

8.4.14 Locating the department

The results of the current study found that patients were satisfied with locating the imaging department. This could be an indication that there is good communication between patients and healthcare workers in various sections of the hospital. The other indication of this finding could be clear directions and signage in the hospitals or availability of porters to accompany patients to the imaging departments. The results of the current study were similar to those in a Ghanaian study by Gawugah (2016: 151) in which a sequential explanatory design mixed methods study was conducted to assess quality in an Imaging department.

8.4.15 Satisfaction with explanation of imaging examinations

Another very important aspect of diagnostic imaging is the explanation of the examination and related instructions to the patient before and during the examination. Both quantitative and qualitative results in the current study revealed that the participants were satisfied with explanation of examination. This finding was similar to that of Mulisa, Tessema and Merga (2017) in which the mean score on this item (3.94) was higher than the average mean score (3.5). Lack of clear explanation and instructions results in repetition of images thus avoidable unnecessary exposure to radiation (Beyer and Diedericks 2010: 24). In addition, Beyer and Diedericks (2010: 25) also found that 87% of the participant in their study were satisfied with the way the examinations were explained to them. These positive findings amongst Radiography studies could be due to the grounding of the need for explanation of examinations and instructions to patients throughout the training of radiographers and other

healthcare professionals. Further to this, radiographers explained during qualitative data collection that they took time to explain to the patients regardless of the heavy workload.

8.4.16 Clarity of instructions at reception

The reception area of an imaging departments should have clear instruction to patients on where to put their folders/patient cards or sit whilst waiting to be called by the radiographer. Most participants in the current study indicated that there were clear instructions in the reception area. This was in keeping with Mulisa, Tessema and Merga (2017: 7) who revealed that 78.7% of the participants in their study reported that there was good communication between them (patients) and reception staff. To improve service delivery and satisfaction in an imaging department, courteous attention by staff at reception is very crucial (Hoe 2007: 646).

8.4.17 Provision of privacy

Performance of imaging examinations often requires that patients remove some of their clothing to avoid image artefacts that may obscure the area of interest. It is therefore essential that the dignity of the patient while changing to a suitable type of clothing be observed by ensuring them the privacy they need. During examination of the private parts like in the case of mammography, barium enema studies and studies of the pelvic area, only the necessary personnel should be present in the imaging and the fewer the better for assurance of privacy. The majority (>90%) of the patients in this study were satisfied with the privacy they received. This finding was similar to that in the Ghanaian study by Gawugah (2016: 125) in which more than 90% of the participants were satisfied with maintenance of privacy. On the other hand, this study yielded better results when compared to other studies (Malangu and Van der Westhuisen 2017: 142; Mulisa, Tessema and Merga 2017: 9) which revealed 51.7% and 55% satisfaction rates respectively. The improvement in this study could be attributed to the fact that South Africa is beginning to rip the fruits of the Batho Pele Principles that were put in place in 1997 to transform

the public service. The earlier assessment of the Batho Pele Principles just more than a decade after its inception proved to be devastating as patients reported that their rights to be treated with respect and dignity were violated (Khoza and Du Toit 2011: 9).

8.4.18 Time taken to perform examinations

The time taken to perform an imaging examination is one of the important factors used to determine patient satisfaction in imaging departments. Shorter examination periods are related to the experience and expertise of the radiographers as well as good communication between the patient and the radiographer. Almost all the patients (92%) in the current study were pleased with the length of time taken during imaging. This is an indication that radiographers compensated for the long waiting times by shortening the time taken for each examination. According to Joshi (2009: 107), an imaging department should have a programme for continuous training of staff to improve their skills, knowledge and competencies. In addition, the imaging department must measure the examination time and take steps to improve patient satisfaction (Hoe 2007: 648). However, equipment related technical challenges can also results in long examination times. In addition, a recent study by Salsabila and Dachyar (2020: 3627) found that changing to a digital radiography system accompanied by Picture Archiving and Communication System (PACS) reduced examination times by 81%.

8.5 THE IMAGE REJECT ANALYSIS

8.5.1 Image rejection rates

Whether an imaging department uses a conventional film processing system, a computed radiography system (CR) or a digital radiography system (DR) to process images, the reject rate remains an important tool to measure the existence of sound management systems in the imaging department. In addition, the reject rate has implications for management and continuous training (Hofmann, Rosanowsky, Jensen and Wah 2015: 1). In the current study, the average reject rate was 11%. These results were similar to those in

of a study by Hofmann, Rosanowsky, Jensen and Wah (2015: 1). However, the setup between the two studies was different in that the current study was a multi-centre study whilst the latter was a single centre study. In addition, the current study was a retrospective review of image reject data collected over three months (October to December 2019) whilst the study by Hofmann, Rosanowsky, Jensen and Wah included images taken for one month (January 2014). Data collected over a longer period makes it possible to observe trends over time and thus is more reliable. On the other hand, the researchers in the study by Hofmann, Rosanowsky, Jensen and Wah were involved in evaluating and categorising images and were able to discuss suitable categories when in doubt. This was the greatest advantage as correct categorising of reject images is key in ensuring accuracy of the reject rate analysis as identifying causes of rejects is the primary purpose of a film/image reject analysis.

The image reject rate in imaging departments in the eThekweni District is considered high as other studies have yielded lower reject rates. These studies include Atkinson, Neep and Starkey (2020: 75) who discovered a 9% average reject rate over a period of 15 months and a Taiwan study (Lin et al 2016: 2) in which reject rates over six months were analysed an average of 4.89% was revealed. Radiation exposure was traditionally the leading reason for high reject rates prior to introduction of CR and DR (Stearns 2004: 57). CR and DR have a wide dynamic range make it possible to receive images of acceptable density and contrast using a range of exposure factors (Stearns 2004: 58).

8.5.2 Reasons for rejection of images

The success and effectiveness of a reject analysis project lies mainly in identifying the reasons for rejection so that the necessary corrective actions can be implemented. It was surprising and concerning to note that many (82.87%) of the rejected images in the current study were categorised as blank. This category was set aside for images that were rejected but the radiographer did not state the reason for rejection. These images involved dispensing of radiation to the patient thus like all other reject images affected patient radiation dose, patient management, patient throughput rate and patient dissatisfaction.

This category was also noted in the Australian study by Atkinson, Neep and Starkey (2020: 75). There is a need to educate radiographers in regional hospitals in the eThekweni District about the importance of ensuring that reasons for rejection of images are entered in the system.

The researcher excluded the category on blank images to control their effect on percentage calculations for other reasons. The rest of the reasons for rejection of images were positioning (26%), exposure factors (28%), motion (7%), artefacts (9.3%), clipped anatomy/collimated sections (13%) and other (for example double exposed and QC tests) at 9.5%. Rejections due to positioning challenges were much lower in the current study than the studies by Atkinson, Neep and Starkey 2020: 75 (49%), Benza *et al* 2018: 36 (63%), Lin *et al* 2016: 2 (64.95%) and Hofmann, Rosanowsky, Jensen and Wah 2015: 3 (51.3%). On the other hand, Monfared Abdi and Saber (2007: 38) observed that positioning constituted 22.79% of the rejected images. During qualitative data collection, the participants alluded to weekly image review sessions. During these sessions positioning of a particular body part would be explained by a radiographer nominated by the Quality Assurance manager. It is suspected that the reasonable low reject rate related to positioning in this study is attributed to this initiative.

During the initial introduction of CR and DR there was a view that reject analysis on such equipment was not necessary (Joshi 2009: 109), as the focus was on reducing film wastage. This view disregarded the impact of image repeats on other factors like patient management functionality of the department and radiation dose (Atkinson, Neep and Starkey 2020: 72). The current study recorded 28% reject rate attributed to inadequacy of exposure factors. This finding was much closer to that of Benza *et al.* (2018: 36) in which 24.9% of images were rejected due to incorrect exposure factors. The findings were however much less compared to those of Monfared, Abdi and Sager (2007: 38). On the other hand, these results were very high when compared to other studies (Atkinson, Neep and Starkey 2020: 72, Lin *et al.* 2016: 2; Hofmann, Rosanowsky, Jensen and Wah (2015: 3). Inadequacy of exposure factors is

usually caused by quantum mottle noise which is a grainy appearance on the image resulting in a reduced image contrast (Carlton and Adler 2013: 333). This results from insufficiency of x-ray photons reaching the image detector. In correcting this the radiographer has to increase the exposure factors thus increasing radiation dose to the patient.

8.6 KNOWLEDGE OF RADIOGRAPHERS REGARDING TOOLS CURRENTLY USED IN INSPECTIONS: NATIONAL CORE STANDARDS

8.6.1 Knowledge of the NCS by the radiographers

All the radiographer participants in the current study expressed that they were aware of the NCS. However, when they were asked to mention a few of the standards they only mentioned aspects such as Health and Safety, Patient Rights and Infection Control. This finding was similar to that reported by Mogashoa and Pelser (2014: 151) in which the participants only mentioned Patient Rights and Infection Control when asked to mention different standards and when they applied. However, Martinez (2017: 243) found that Staff Nurses were very compliant in National Core Competency Standard.

On explaining reasons for their ignorance on the NCS, radiographers in the current study cited lack of workshops and departmental discussions on NCS. Some of the participants expressed that weekly talks were held in their department, but they have been on night shift during such trainings. In addition, the radiographers stated that their managers had the knowledge about the NCS as they were involved with related activities. In some hospitals, the participants expressed that there was no time for such talks due to high workload and high patient volumes. These reasons align to the problems resulting in non-compliance experienced by participants in the study by Martinez (2017: 259) in which the participants cited time limitations, workload and lack of feedback. Radiographers and Radiography Managers have a duty to educate each other on the quality improvement initiatives enforced by the government. A comparison assessment of progress towards universal health coverage between Brazil, Russia, India, China and South Africa, revealed that human

resources in healthcare is a huge challenge in South Africa (Marten *et al.* 2014: 2168). It is therefore important that the few health workers who are holding the fort try their best to improve the healthcare service.

8.6.2 Relevance of the assessment tool

Two of the Radiography Managers stated some concerns regarding the tool as well as the process of licensing inspections. The participants were concerned that the tool is outdated in that it was still addressing some of the old technology which is no longer used in most hospitals in the district. This finding was confirmed by Chellan and Sibiya (2018: 509) in a mixed methods study in which the participants in both qualitative and quantitative strands agreed that there was inadequate assessment of Clinical Support Services domain during licensing inspections. Participants in the current study recommended that radiographers should be consulted prior to undertaking of licensing inspections. This view is highly supported especially as radiography is highly technical and very dynamic. The assessor also needs to abreast with requirements of many institutes regulating radiography services like the SAHPRA Board of the Department of Health and the ICRP.

Another recommendation made was that the process needed to be more structured and perhaps include interviewing of staff by the panel. According to the participant this would provide the panel with better incite of the imaging services and staff would also learn more about the requirements of the NCS. As recommended by the participants in the study by Chellan and Sibiya (2018: 509), there is a need to design a more comprehensive and relevant assessment tool to be used in imaging departments during inspections.

8.6.3 Departmental performance during inspections

The Quality Assurance Managers were very happy with the performance of the Imaging Departments during the inspections. All the Imaging departments in regional hospitals in which the data were collected obtained scores above 90%. The areas in which scores were lost were not the core functions of an Imaging

department as they included missing items from the resuscitation trolley, lack of explanation of the call-out systems and absence of evidence for performance of darkroom tests. On a positive note, the Imaging departments were quick in developing Quality Improvement Projects (QIP) to address outstanding areas. The fact that the score was this high is quite impressive, however the scores were less than those noted in a study by Chellan and Sibiya (2018: 19) in which reported that the Clinical Support Services in private hospitals in the eThekweni District obtained 100% scores for all documents required during the inspections.

8.7 FACTORS AFFECTING QUALITY IN IMAGING DEPARTMENTS

8.7.1 Communication

Factors regarding communication which affect quality services in diagnostic imaging departments are discussed below.

8.7.1.1 Requisition forms

All imaging services have a duty to ensure that clinically relevant information is received from the referring healthcare providers who are mainly doctors in the case of the regional hospitals (Makanjee, Bergh and Hoffmann 2015: 198). A request form is used as a means of formal communication between the requesting doctor and the radiographer; thus, it must be structured such that all necessary details will be available in it. Doctor participants in all regional hospitals stated that there were request forms for all examinations. What was strange is that in an Imaging department that used 100% digital equipment with PACS, doctors still used a paper-based form for requisition of imaging examinations. The uniformity on the availability of request forms was probably attributed to the enforcement of the availability of such by the SAHPRA Directorate of the Department of Health (2014: 1). On the other hand, there is an urgent need for the departments to install software for online requisitions particularly in Imaging departments with PACS. The dropdown menu on the online version of the request form makes it easy for doctors to complete requisitions thus saving on already depleted time in busy hospitals.

8.7.1.2 Communication between patients and radiographers

The communication between the radiographer and the patient is important for many reasons including validating the anatomical structure to be imaged. The majority of the participants in the current study were satisfied with their communication with radiographers. The results of this study were similar to other studies (Mulisa, Tessema and Merga 2017: 7 and Arthur *et al.* 2013: 46). Further to this, the communication between the patient and workers in the imaging department is important as the radiology team might want to ask the relevant questions not appearing on the request form (Larson and Langlotz 2017: 994). In addition, good communication assists in ensuring understanding of instructions particularly during examinations.

On the other hand, there was disagreement between quantitative and qualitative results in the current study in that the qualitative results revealed that there were elements of dissatisfaction in communication between patients and personnel. In a study by Arthur *et al.* (2013: 46), women undergoing mammography examinations found verbal communication helpful in enduring the pain during the examination and thus achieving outcomes of the examination. This is highly important in imaging as patient cooperation is very important for successful imaging examinations. On the other hand, it is always important to remember that at times healthcare workers become extremely overwhelmed and thus lacking the time to improve their communication with patients (Chopra *et al.* 2009: 1026). It is for this reason that the UK government put in place strategies to enhance communication between patients and service providers (Booth 2008: 323). In addition, a study on communication errors in Imaging departments (Siewert, Brook, Hockman and Eistenberg 2015: 576) found that almost 40% of communication errors had a direct impact on patient care.

Two main issues of concern in the current study related to the professional behaviour of staff when dealing with patients. There was dissatisfaction among staff members with regard to calling of patients by first name and level of rudeness displayed by some members of staff to patients. These findings were

similar to those revealed in a recent study by Magana (2020: 8) in which the patients experienced unfriendly encounters and discrimination. In addition, the study by Pollard, Lincoln, Nisbet, and Penman (2019: 335) expressed the importance of good communication between patients and radiographers.

Regarding calling patients by first name, contrary to the finding in the current study, Johanson *et al* (2020: 45) found that patients were impressed when the robot receptionist called them by first name. Whilst healthcare professionals are taught to call patients by first name, it is important for professionals to consider preferences among various traditions.

8.7.1.3 Communication between patients and doctors

Radiographer participants expressed their concern regarding the communication between patients and doctors. According to radiographers, lack of communication between doctors and patients affected quality of their work as patients would at times present requests that were not aligned to their clinical history. One of the participants made an example of request for imaging of the whole arm when only the wrist was affected. A similar finding was expressed in a study by Magana (2020: 8) where patients explained that doctors were stressed and did not do the medical examinations properly. In addition, a study by Siewert, Brook, Hochman and Eisenberg (2015: 576) found that there were errors in 13.9% of imaging requisitions. Radiographers have a duty to minimise radiation to the patients by ensuring that each patient benefits from any amount of radiation that they have been exposed. To add on, many factors could have resulted to this finding and these include high workload and poor interpretation between doctors and patients.

8.7.1.4 Communication between doctors and radiographers

Ongoing communication between doctors and radiographers is essential to improve the patient experience in the hospital setting. The current study revealed that in some departments, the radiologists held regular meetings with clinical heads of departments to discuss issues arising from the Imaging

department and vice versa. On a day to day basis, request forms are used to communicate doctors' requests but at times there are discrepancies with the requests. Challenges persist beyond these initiatives as some doctors expressed dissatisfaction emanating from performance of incorrect examinations by radiographers whilst radiographers expressed their unhappiness with the manner in which the requests were written. Makanjee, Bergh and Hoffmann (2015: 12) stressed the importance of doctor-radiographer's interactions in order to enhance the patient experience in their journey through the multi-level referral systems. In conclusion, good communication between referring doctors and radiographers should promote best patient care, support the ordering doctor and must be designed to satisfy the need for timeliness, and minimise the risk of communication errors (American College of Radiology 2001: 3). Telephonic resolution of challenges or personal discussions are necessary to ensure speedy and amicably resolutions.

8.7.2 Image quality

Doctors are the major requesters of imaging examinations in the South African public service. In addition, a radiographic image should possess characteristics suitable for it to assist in patient diagnosis (Candiso *et al.* 2013: 8) and such characteristics must include image contrast, resolution, density, sharpness and detail. In addition to these, the radiographer must take reasonable steps to ensure that the correct anatomical structure based on patient history is imaged. The South African Guidelines for making request for Medical x-rays express the need for effective communication between the doctor and the radiographer to ensure that radiation dose to the patient is optimal HPCSA 2014:2. In addition, positioning of the structure must be adequate and correct centring point is to be used. Lastly and very important is that the correct patient must be imaged and all images must be labelled with the patient's name and anatomical markers (Metal marker used by the radiographer to mark the right or left side of the patient) must be used correctly.

Doctor participants in the current study expressed their dissatisfaction with the quality of images provided by the Imaging departments. The areas of concern included clarity of images, positioning, image identification and imaging of unaffected (unrequested) body parts. The findings in this study were similar to those in a study by Utami (2020: 14), in which the researcher revealed that there was significant association between image quality and satisfaction of the requesting doctor. In addition, a South African study by Sebelego, van der Merwe and du Plessis (2019: 5) showed that positioning was incorrect for 70% of the images and four-sided collimation was not achieved in more over half of the images due to incorrect centring points. It is important to note that whilst some qualities of the image can be changed by the radiographer at the workstation during post processing, images cannot be readjusted once they have been sent to the PACS. For this reason, radiographers should try their best to set correct exposure factors to avoid this challenge (Bontrager and Lampignano 2014: 51; Pongnapang 2005: 2).

Some of the doctors expressed that at times they had to request other diagnostic tests like blood tests due to the bad quality of images. This is a huge disadvantage for patients as the diagnosis time takes longer. Radiographers are to try their best to ensure that the best diagnosis is obtained at the first attempt (Moller 2016: 312). In addition, actions of this nature result in the reduction in patient satisfaction and unnecessary extra costs for the state (Gijo and Antony 2013: 1481).

Radiographers sited equipment faults and high patient volumes as the reasons for poor image quality. The current study did not evaluate the images to find the exact reasons for poor images. However, it is envisaged that equipment faults could mainly affect exposure selection. In the study by Sebelego, van der Merwe and du Plessis (2019: 8), it was found that most technical abnormalities were due to substandard work by radiographers. The same study also revealed that some of the images were taken by student radiographers and community service radiographers. This study exposed the need for proper supervision of radiographers in training.

It was also noted that complaints on poor image quality were stronger in some hospitals than in other. In some hospitals, doctors expressed that image quality was quite good. It was also quite exciting to hear from radiographers that they intended to produce images of optimal quality in order to facilitate correct diagnosis by the doctor. Radiographers further alluded that they were the eyes of the medical field hence had to work hard to produce images of high quality. This was in keeping with the study by Moller (2016: 312) in which the radiographers were reported to be doing everything possible to ensure that the image was a good one.

8.7.3 Image acquisition protocols

Radiographers in the current study expressed that they do requested images even if they were not relevant. This adds unnecessary radiation to the patient together with avoidable workload. Furthermore, each imaging department has to put in place protocols for acquisition of images for all examinations provided by the department (Joshi 2009: 103). In addition, protocols must be agreed by all stakeholder and be communicated to all sections of the hospital. In South African this initiative is left to each Radiography Manager as these are not enforced. Radiographers are trained on assessment of the request form to ascertain the necessity for the examination in order to avoid unnecessary radiation to the patients.

It is sometimes noted that clinical history is insufficient or inadequate (Shah, Linam and Greenberg 2013: 1269) and this may result in inaccuracy of the report by the radiologist (Loy and Irwig 2004: 1605). It is therefore critically important that history taking be a large component during training of doctors and that radiologists take all reasonable steps to train doctors on the importance of recording relevant clinical history (Waite et al 2018: 266).

8.7.4 Image quality control

In two of the regional hospitals there was a system in place in which one of the Assistant Directors reviewed images before they are sent to the requesting doctor or read by the radiologist. This was a good initiative as a review of

archived images in a study by Hsiao *et al.* (2020: 53) found many quality associated challenges including artefacts, collimation, positioning and other aspects. It is believed that a similar system needs to be implemented across regional hospitals in eThekweni District to reduce some of the challenges experienced by doctors as revealed in the current study.

Radiography is a skill and one perfect; it after many years of experience in a relevant area. It also exciting to find that in some hospitals, radiographers struggling with certain views, can call for assistance of the Assistant Director allocated to work on Quality Assurance. This initiative is applauded as the notion that the newly qualified radiographers must hit the ground running does not work for the benefit of quality improvement (Harvey-Llod and Stew 2019: e65) as support from the well experienced radiographers is needed. Further to this a study by Dlamini, Sekoli and Bresser (2019: 110) established that the majority of community service radiographers felt that there was a need for them to be oriented, mentored and supported in the hospitals in which they were place, however the qualified radiographers expected too much from them. Another study conducted within the eThekweni District (Chipere, Motaung and Nkosi 2020: e15) showed that newly qualified radiographers appreciated support from other radiographers. The major benefit of this mentoring is enjoyed by the patients, as the number of repetition of images is monitored and controlled thus, they should spend less time in the imaging room and experience less exposure to ionising radiation. It was therefore quite concerning that in one of the Imaging departments there was no system in place to enhance image quality assurance. It was also observed that most complaints for poor radiographic image quality emerged from doctors in the same hospital. Further to this although reject analysis was done in this particular hospital, it was not used to improve quality of images.

8.7.5 Radiology reports and shortage of radiologists

The medical team relies on the radiology system for provision of a report that outlines the reasons for the symptoms and signs experienced by the patient (Pauker and Kassirer (1980) in Larson and Langlotz 2017: 992). In South Africa

and most parts of the world, the task of producing a radiology report is entrusted to the radiologist. In the current study, doctor participants complained that they were not receiving radiology reports, and had to interpret images themselves. A statement in line with this finding was noted in a South African study by Kekana, Swindon and Mathobisa (2015: 1115), who further stated that there were 7771 radiographers and 885 radiologists in South Africa in 2013. On the other hand, delay or unavailability of image reports can result in medical errors which can in turn result in avoidable patient deaths (Donnelly, Dickerson, Goodfriend and Muething 2010: 1184). Some of the healthcare providers are unable to interpret radiographic images on their own (Semakula-Katende, Andronikou and Lucas 2016: 1387). Participants in the current study further called for reporting of all images. Hoe (2007: 644) states that such a service must be available at all times. In a South African context as it is currently known, such a call is impossible unless major changes occur as radiologists are very scarce. Further in a South African study by Kekana, Swindon and Mathobisa (2015: 1120) found that only a quarter of radiographers were in agreement with them providing a written report to the requesting doctor. On the other hand, Wuni, Courtier and Kelly (2020: e121) advocated for radiographer reporting. Such an initiative would need to be accompanied by structured training of radiographers on image reporting together with increased intakes for radiography students to avoid depletion of the radiography work force. In canvassing this view, Gqweta (2012: 24) states that radiography training in South Africa includes a certain level of image interpretation. This was further confirmed by Buskov *et al.* (2013: 56) in which radiographer reporting was found to be of a significant high standard when compared to that of trainee radiologists.

8.7.6 Facilities and Resources

Facilities and resources in diagnostic imaging departments are discussed below.

8.7.6.1 Status of Imaging Equipment

Imaging equipment is key in provision of sound services in any imaging department. The participants in the current study expressed major challenges

including insufficient and outdated equipment. Despite these challenges, the commitment of radiographers to their employer worked in the favour of patient satisfaction, as radiographers did the best possible to ensure that a service was provided to patients. The findings in this study were similar to those in the study by Deshmukh and Thakur (2019: 8199), who found that almost 50% of the Community Healthcare Centres possessed non-functional imaging equipment. In addition, it is known that imaging equipment is a huge challenge for developing countries (Date and Ohkado 2018: 411). Participants also stated that many x-ray rooms were dysfunctional whilst some rooms could only be used for certain examinations due to their limitations, including floor mounted x-ray tubes in which multi-trauma patients with limited movement could not be imaged. In addition, in one of the hospitals fluoroscopies was not available for more than three years and there was a long backlog of mammography patients. Delays in diagnosis result in uncontrolled progression of the disease processes and in cases of infectious diseases like tuberculosis there are more cross infections.

8.7.6.2 Quality control tests

In South Africa the Department of Health through the SAHPRA Directorate stipulates and ensures performance of quality control tests. The major advantage of performing these tests is low radiation dose and maintenance of adequate image quality. Participants in the current study expressed that quality control tests were not being performed in some of the hospitals. These results were similar to those in a study by Ngoye, Motto and Muhogora (2019). On the other hand, the results were different to those in a South African study by Willemse, Williams and Grobler (2020: e3). Lack of management support was common in both studies, but in a study by Willems, Williams and Grobler (2020), participants expressed that they were committed and dedicated to the extent that some of their tests were performed at their own preferred time. In two of the hospitals in the current study, Radiography Managers took steps to motivate radiographers to perform quality control tests and this was found to be working well. It is envisaged that performance of studies similar to the current study will

encourage more departments to take the necessary steps to perform quality control tests.

8.7.6.3 Image processing systems

The public hospitals in the eThekweni District were transforming to a more digital environment during data collection of the current study. Two hospitals still had about 25% of conventional wet processing, whilst one was 100% converted to CR and the other one was using mostly DR with limited CR applications. Benefits of converting to a total digital system were noted in a study by Nitrosi *et al.* (2007: 144) in which a significant improvement in turnaround times and financial savings were noted. The eThekweni District can resolve a number of its challenges thus improving patient care by implementing digital radiography.

8.7.7 Workplace reviews

High workload and severe staff shortages were found to be the major issues affecting quality in the current study. Similar results were observed in a study by Snaith, Hardy and Lewis (2015: 121) in which the Imaging department was found to be 16 radiographers less than required for its workload. A study on the factors resulting in retention of radiographers in KZN (Thambura, Swindon and Amusa 2014: 1205) found that radiographers were unhappy with high workload and low remunerations. Participants further stated that unnecessary images were requested for car accident victims as patients demanded imaging in order to claim from the Road Accident Fund. Some of the participants stated that there was one radiographer working night duty in the entire hospital. This resulted in unacceptable patient waiting times and poor service to the patients.

8.8 CHAPTER SUMMARY

In this chapter, literature was used to discuss findings of the study. It is well noted that quality expectations are different for each group of the participants. The factors affecting quality as found in this study are mostly similar to those observed in other African studies. There is however an urgent need to take

necessary steps to changes some of the aspects revealed in this study. In addition, imaging departments in regional hospitals in the eThekweni District need a framework that will guide and facilitate adequate quality. The following chapter will be used to describe the design of a quality framework for medical imaging services in regional hospitals in the eThekweni District.

CHAPTER 9: A PROPOSED QUALITY FRAMEWORK FOR MEDICAL IMAGING SERVICE DELIVERY IN REGIONAL HOSPITALS IN THE ETHEKWINI DISTRICT, KWAZULU- NATAL

9.1 INTRODUCTION

In this chapter the researcher takes steps to assess realisation of the research purpose. The purpose was to identify current practices affecting quality of service delivery in regional hospitals within the eThekweni District in order to develop a framework that can be used to guide and improve quality of service delivery. The researcher is carefully considering data collected from both quantitative and qualitative strands. A framework synthesis is then used by reducing the discussion of the findings, hence developing a framework. The framework contains linkages between various actions required to improve quality as discussed in the sections to follow.

9.2 REALISATION OF THE RESEARCH OBJECTIVES

The first five objectives of the study were to:

- Establish image reject rates and reasons attributing to image rejection. Investigate levels of patient satisfaction in the imaging departments.
- Assess perceptions of radiographers regarding the tool currently used in licensing inspections.
- Assess the factors affecting quality in imaging departments.
- Explore quality improvement strategies that can be employed in imaging departments.
- Develop a framework that can be used to improve quality in the medical imaging departments.

Table 9.1: Summary of major findings per objective

OBJECTIVE	DATA COLLECTION STRATEGY	MAJOR FINDINGS
Establish baseline data of factors affecting quality in imaging departments of regional hospitals in the eThekweni District of KZN.	Quantitative: Image reject analysis	<ul style="list-style-type: none"> • Reject analysis not performed in one of the regional hospitals. • Some hospitals do not use reject analysis to improve quality. • Some radiographers do not provide reasons for rejection of images. • Rate of image rejection is high. • Reasons for rejection of images are related to equipment faults, patients and lack of in-service training. • Reasons for image rejection include inadequate positioning, inadequate exposure factors and artefacts.
Investigate levels of patient satisfaction in the imaging departments.	Quantitative: Patient satisfaction survey	<ul style="list-style-type: none"> • Most patients were satisfied with many aspects of the imaging departments. • Most patients were dissatisfied with comfort of the waiting area. • Patients were moderately dissatisfied with the length of time they spent in the waiting area. • Cleanliness of the Imaging departments was the most satisfying aspect for most patients.
Assess perceptions of radiographers regarding the tool currently used in licensing inspections.	Qualitative: Interviews with radiographers and Radiography Managers.	<ul style="list-style-type: none"> • Radiographers do not clearly understand the National Core Standards (NCS). • Many radiographers have not participated in workshops on NCS. • The tool used for inspections needs to be revised to include relevant current information.

		<ul style="list-style-type: none"> • The process of inspections needs to be revised to include structured interviews. • Imaging departments have performed very well during inspections.
Assess the factors affecting quality in imaging departments.	Qualitative: Interviews with doctors, Quality Assurance Managers, Radiography Managers and radiographers.	<ul style="list-style-type: none"> • Communication between Imaging departments and other departments needs to be improved. • There is an urgent need to improve communication between doctors and radiographers. • There is a severe shortage of radiographers and radiologists. • Images on conventional radiography are not reported on. • In some hospitals there is only one radiographer working after hours. • Radiography departments are leading in development of Quality Improvement Projects following inspections. • There are no protocols existing on acquisition of images. • There is a need for a continuous in-service training of radiographers on various aspects of service delivery. • There is a very high workload. • Patients access regional hospitals without following proper referral channels.
Explore quality improvement strategies that can be employed in imaging departments.	Qualitative: Interviews with doctors, Quality Assurance Managers, Radiography Managers and radiographers.	<ul style="list-style-type: none"> • Employment of radiologists and radiographers. • Maintenance and purchasing of equipment as required for a regional hospital. • Strengthen communication at various levels. • Develop protocols for acquisition of images.

		<ul style="list-style-type: none"> • Availability of senior radiographers to support junior radiographers. • Radiologists to cover after hours. • Reporting on all images. • Development of protocol for emergencies. • Conversion to digital equipment with PACS. • Continuous in-service training for radiographers. • Availability of senior radiographers during after hour shifts. • Installation of more equipment with ceiling suspended x-ray tubes.
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To achieve the final objective of the study, the primary researcher took some time and considered whether all the research objectives for this study have been met. For this reason, Table 9.1 was designed and illustrates the major findings revealed per each objective of the study. These findings together with the conceptual framework are thus used to develop the practice framework.

9.3 DEVELOPING A FRAMEWORK FOR QUALITY SERVICE DELIVERY IN IMAGING DEPARTMENTS

The findings of the current study as exposed in findings from all the objectives have indicated an urgent need for a framework to guide quality service delivery in imaging departments of the regional hospitals in the eThekwin District. The proposed practice framework illustrated in Figure 9.1 is a circular figure of four quadrants with each quadrant attached to a rectangular structure in the periphery.



Figure 9.1: Framework for quality improvement in Imaging Departments in regional hospitals in the eThekweni District of KwaZulu-Natal

9.4 PILLARS OF THE PRACTICE FRAMEWORK

9.4.1 Quality Assurance

As discussed in the conceptual framework of the current study QA considers quality related aspects that involve people. The QA system provides a confirmation that systems with an imaging department work properly. In terms of the results from the current study, the proposed quality framework includes a Departmental QA committee (DQAC), and a customer satisfaction survey.

9.4.1.1 Departmental Quality Assurance Committee

It has been noted that in all regional hospitals in the eThekweni District there are hospital wide QA committees driven by the institutional QA Managers who were interviewed during data collection. However, departments do not have such committees and this framework proposes development of such a committee. The DQAC will ensure that institutional mandates on quality improvement are cascaded down to the departments where actions must be taken to implement resolutions of the institution. The DQAC will therefore communicate institutional decisions on quality improvement to both the departmental management and departmental staff. Amongst the functions of this committee will be the development of image acquisition protocols. The absence of image acquisition protocols in imaging departments can lead to miscommunication between radiographers and doctors revealed in this study. In addition, the DQAC should ensure sound departmental quality assurance systems including performance of customer satisfaction surveys.

Customer satisfaction surveys are a good start in improving systems (Lang *et al.* 2013: 1191). Quality Improvement Projects/Plan should be developed based on customer satisfaction surveys. This committee should also consider development of structured image quality assurance. The results of the current study revealed that in some of the departments an Assistant Director would be allocated to review images taken by radiographers prior to them sent to the requesting physicians. This practice is confirmed by the conceptual framework to be a good undertaking; however, it is not consistently applied, and its

effectiveness is not measured. In some departments it is not practiced at all whilst in some of the departments it is only performed on availability of staff to perform it. In view of the shortage of radiologists accompanied by lack of image reporting, this practice should be performed consistently and in all the imaging departments. The DQAC is a critical committee and the convener hereof will need to be one of the Assistant Directors/radiologist/physicists where possible. An individual with good communication skills and knowledge of quality assurance aspects of a radiology department will be best suited to hold this position. In addition, such a committee should be inclusive of representatives from all staff categories in the department.

9.4.1.2 Customer satisfaction

Customers are in the centre of any imaging departments and it is through satisfaction of customers that a business can improve its quality (Kruskal *et al.* 2011: 1500). The main customers of an imaging department are physicians, patients and employees. Furthermore, customers should be in the core of departmental endeavours to improve quality. In addition to daily communication between the departments and their customers, regular customer satisfaction surveys will need to be undertaken. The findings from such surveys will be instrumental in developing strategies to improve quality within the imaging departments. Literature revealed that patient satisfaction surveys are the most performed satisfaction surveys whilst satisfaction surveys amongst physicians and employees are very seldom conducted (Erturk, Ondategui-Parra, and Ros 2005: 988). However, deeply thought out and planned frequencies for these surveys are critical to ensure that discoveries are well managed.

9.4.1.2.1 Physician satisfaction survey

The current study did not include a physician satisfaction survey, however doctors were interviewed and revealed a number of aspects requiring quality improvement. Interviews with doctors further revealed what doctors thought about the quality of imaging services. The interviews also exposed that doctors were not aware of the desires of radiographers to offer a defective free service to the hospitals and thus were not aware of the challenges faced by imaging

departments in their endeavours to offer quality services. It is therefore important for imaging services to undertake surveys to get the views and perspectives of physicians about the services rendered by the imaging departments in order to improve quality of imaging services (Jossen, Valeri, Heilmaier, and Schwappach 2019: 730 and Kvamme, Olesen and Samuelsson 2001: 35). Although obtaining the views and perspectives of physicians on the quality offered by imaging departments is such an important endeavour, there are very few imaging departments that conduct satisfaction surveys on physicians (Jossen, Valeri, Heilmaier, and Schwappach 2019: 730). The frequency for performance of physician satisfaction surveys can be left to each Imaging department to decide but at least one should be conducted in the space of a year. Results must be communicated with all physicians and a Quality Improvement Plan should be developed within three months following publication of the results. This will be another strategy to enhance communication between the imaging department and its customers.

9.4.1.2.2 Patient satisfaction surveys

The current study involved a patient satisfaction survey and patients were satisfied with most aspects investigated. To enhance quality in imaging departments it is essential to conduct patient satisfaction surveys as patients should be in the centre of a successful imaging department (Moller 2016: 309; Itri 2015: 1842). Furthermore, the main intention must be to close the gaps that might be exposed by such initiatives (Erturk, Ondategui-Parra and Ros 2005: 987). QA Managers in all four regional hospitals in which research was conducted agreed that patient satisfaction surveys are mandatory in hospitals in the eThekweni District, however some imaging departments did not comply with this requirement. The frequency of conducting patient satisfaction surveys was not revealed in the current study, however literature (Erturk, Ondategui-Parra and Ros 2005: 987) established that quarterly surveys were more ideal. Such a frequency will ensure that there is sufficient time to close gaps exposed by the previous survey whilst allowing for the changes to be effected prior to conducting another survey. It should also be remembered that rendering quality initiatives to humans is such a complex process as a group of people might be

dissatisfied by the aspects that were found to be satisfactory by another group of people. For this reason, it is important to be strategic when sampling for patient satisfaction surveys to ensure that different groups are represented as much as is reasonably practical. Results should be communicated to all stakeholders including employees and management depending on the possible solutions for areas of satisfaction and dissatisfaction. The South African government has taken several initiatives to ensure (and enforce) customer (particularly patients) satisfaction and motivations from Radiography Managers indicating the voice of patients would bear more weight than statement based on mere aspirations by the imaging department.

9.4.1.2.3 Employee satisfaction surveys

Employee satisfaction surveys were not included in the current study; however, radiographers and Radiography managers were interviewed and a number of issues relating to staff satisfaction emerged from the interviews. These issues included high workload, faulty equipment, poor communication between radiographers and patients, poor communication between doctors and radiographers and others. Furthermore, according to literature, staff satisfaction is one of the strategies to be used in enhancing quality in an organisation and can be enhanced by engaging in a programme on Quality of Work Life (QWL). QWL is explained by Bidmeshkipour (2009: 34) as a comprehensive programme with the aim to improve employees' satisfaction and help them to better manage change. Such a system would be best for the eThekweni District as most departments are at transitional state in terms of the image processing systems used. Employee's satisfaction surveys would also assist in improving employee core values like care and respect. In addition, surveys conducted in the eThekweni district were specific to stressors to radiographers (Gam, Naidoo and Puckree 2015) and reasons for high turnover (Thambura, Swindon and Amusa 2014). These studies were only specific to certain aspects among radiographers and comprehensive surveys including all employees in imaging departments should be carried out on a regular basis. The frequency of conducting such surveys should be at least a period of six months conducted in the middle of the year. The reason for conducting these in the middle of the

year would be to ensure that any employees resuming employment at the beginning of the year including Community Service radiographers and registrars are able to provide valuable input and will benefit from measures put in place in response to the survey feedback. This would assist in retaining staff (for example community service radiographers and registrars).

9.4.2 Quality control

The DQAC should facilitate adequate performance of quality control tests and thus ensure compliance with SAHPRA Board requirements. This committee should further engage the departmental management to ensure training of radiographers in performing QC tests. Further to this, the committee must facilitate allocation of resources including time and necessary equipment and instruments for performance of the QC tests. Both the results of the current study and literature are in agreement regarding the fact that lack of these resources results in non-performance of the quality control tests. It also emerged during interviews that in some imaging departments maintenance of equipment was not performed regularly. It was further revealed that the non-performance of maintenance was attributed to lack of maintenance contracts. Decision makers regarding imaging equipment have to prioritise provision of resources to ensure maintenance of all equipment to improve quality of care in the imaging departments in the eThekweni District. Image reject analysis is another important component of quality improvement.

Image reject analysis is a very important tool in unearthing areas affecting image quality, patient throughput, avoidable radiation dose and departmental wastage. All of these aspects can be improved through use of the image reject analysis and implementation of the necessary interventions. The DQAC should also lead and must be dedicated in performance of image reject analysis and the results of these must be used in improvement of service quality. Areas resulting in high image reject rates must be investigated and corrective steps must be undertaken. Corrective measures need to be aligned to staff development.

9.4.3 National Core Standards

The results of the current study also revealed that radiographers are not acquainted with the NCS and it should be the duty of the DQAC to train all categories of staff in the department on these standards. In addition, the committee should raise aspects of the standards that need modifications with the Hospital QA committee so that such recommendations can be escalated to the relevant district/provincial quality structure. Furthermore, development and activation of QIPs as noted in the current study should be continued so as to keep improving quality in the imaging departments.

9.4.4 Quality Management

Quality Management (QM) is defined as an umbrella system for all quality processes and procedures. QM should include systems used to direct, coordinate and control quality. Moreover, QM should include quality planning, quality assurance, quality control and quality improvement (International Standards Organisation 2015: 6). The principles for QM are customers, leadership, people engagement, improvement of processes, management of relationships and evidence-based decision making. Based on the conceptual framework guiding the current study as well as results obtained, the proposed framework will include communication, staff training and development, mobilisation of resources, staffing and adequacy of equipment.

9.4.4.1 Improvement of communication

Based on the results and the conceptual framework used in the current study, for the framework to be sufficiently effective communication amongst key stakeholders will have to be strengthened. The departmental management teams led by the Radiography Managers will need to steer the entire quality process through effective communication. The results of the current study have indicated a need to enhance communication between the department and its customers mainly patients (external customers) and doctors (internal customers). The results of the current study together with the conceptual framework expressed a number of areas in which the Radiography Managers

have to communicate with the hospital management and other funders. This should form the major component of the functions for a Radiography Manager.

Moreover, the Radiography Managers (RMs) must enhance communication between doctors and radiographers using a range of strategies. The most effective strategy would be to ensure that radiographers are clear about their roles and responsibilities. This is very important as in a South African context radiographers and doctors interact daily in a transactional manner (Makanjee, Berg and Hoffmann 2014: 155). In addition, the conceptual framework used in the current study explains that the clinicians depend on the imaging department for radiological diagnosis of patient conditions (Larson and Langlotz 2017: 992).

Both the Quality Improvement Guide (South Africa 2012: 8) and Larson and Langlotz (2017: 997) emphasize the need for teamwork in the provision of healthcare and the RM needs to be instrumental in monitoring this teamwork not only amongst members of the department but also between the department and its customers. On the other hand, the RM should drive the development of protocols so as to ensure that physicians are clear about accessing a range of modalities within the department. In addition, image acquisition protocols should be developed so that radiographers and radiologists are clear about the techniques to be performed for all examinations. In addition, the RM should ensure continuous accessibility of services. In undertaking this task, the RM should put in place strategies to ensure availability of staff at all times including during tea and lunch breaks. Sufficient staff during night duty, public holidays and weekends is a critical function of the RM. All these aspects must be taken into consideration when calculating staff complements.

9.4.4.2 Staff training and development

Results of the current study have indicated that staff training and development are very limited in imaging departments. This involves training of radiographers on the correct usage of all equipment modalities. This is recommended as good understanding of imaging equipment relieves the user from unnecessary stress

and thus a radiographer can focus on other aspects of quality improvement. These other aspects would involve amongst others enhanced communication between the radiographer and the patient thus resulting in the patient understanding the instructions by the radiographers and or/radiologists. This will in turn result in improved patient satisfaction and enhanced image quality including less repeats. When repeats are reduced the radiation dose to the patient is also reduced and patient throughput rate is improved. This would eventually add to reduction of the waiting times.

Staff development and in-service training is another highly important function of the RM. The findings of the current study showed that in-service training was only performed in some departments within the eThekweni District. The in-service training should be conducted based on the results of the surveys completed by the department. These would include customer satisfaction surveys and image reject analysis. The current method of identifying images to be used for in-service training is encouraged but should be more structured so that its effectiveness can be measured.

9.4.4.3 Mobilisation of resources

Successful mobilisation of resources needs good communication skills by the Radiography Manager. Sound communication with hospital management, district and provincial managers is fundamental. The South African National Department of Health has long recognised that the healthcare system is experiencing lack of resources (South Africa 2007: 3), but the influence of the RM to hospital management in prioritising imaging services is key to quality improvement of imaging services. Moreover, there is a need to always remember that as much as the South African government has taken strides in improving healthcare since the dawn of democracy in 1994, shortage of human resources and equipment (Maphumulo and Bhengu 2019: 8).

9.4.4.4 Staffing

Both qualitative and quantitative findings of the current study exposed a severe shortage of radiologists, radiographers and support staff. The study did not measure the number of staff members per population, but literature has revealed critical shortage of radiologists and radiographers in developing countries. For example, a study conducted in Kenya (Korir *et al.* 2013: 85) found that a radiologist in Kenya performed 325 000 examinations per year and a radiographer performed 189 900 examinations per year. A previous study in the eThekweni District found High workload to be a stressor amongst radiographers (Gam, Naidoo and Puckree 2015: 19). It is the core function of the Radiography Managers to present motivations for improved staff levels to hospital management. Further to this, there is a call by participants in the current study for reporting of all images. There is an urgent need for the South African healthcare sectors to decide on the best model for this call. Whilst it has been proved that radiographers can easily assist radiologists in image reporting, there is also a need to carefully consider the impact of extending radiographer's scope on the radiographer workload. These motivations should then be followed by recruitment, selection and appointment of suitable experienced and qualified individuals. Following appointments, retention strategies based on research have to be implemented. Another study in the KZN province (Thambura, Swindon and Amusa 2014: 1205) found that there were limited career progression opportunities for radiographers, and this led to high turnover of radiographers.

Staff development amongst radiographers in the eThekweni District is very limited due to staff shortages. The highest qualification for almost 62% of the radiographer participants in the current study was a Bachelor's degree. The reasons for reluctance to study further amongst radiographers are not clear but these could be related to high patient volumes and staff shortages together with stress caused by other factors within the imaging departments. Career planning for radiographers should focus on developing the profession rather than individuals (Anderson, Lundgren and Lunden 2017: 295). The RMs should remain motivational for staff in their departments to study further. Further, staff

should be encouraged to undertake qualifications that will add value to quality enhancement in the departments. To motivate staff to undertake such studies might require implementation of incentives.

9.4.4.5 Adequacy of equipment

The results have revealed several equipment related discrepancies and necessary actions have to be undertaken to remedy the situation. Again, these have to be facilitated by the Radiography Manager in consultation with various stakeholders within the department including radiologists, Assistant Directors, equipment vendors and members of the DQAC. Another very important aspect is maintenance and replacement (considering advances in technology and new techniques) of equipment. In addition, another important aspect of quality improvement recommended by participants in this study is migration to complete digital radiography system with Picture Archiving and Communication System (PACS). Currently two of the departments are still using a combination of wet processing and computed radiography (CR). Another one employs CR whilst one department has migrated to full digital radiography (DR). The advantages of using full DR have been highlighted by literature and have in addition been observed in this study including aspects as illustrated in the proposed practice framework in Figure 9.1.

9.4.4.6 Validation and implementation of the quality framework

All clinicians who were requested to validate the practice framework in terms of its inclusiveness, and ability to address in these hospitals. However, the framework can be used in any imaging department or district in which similar conditions as revealed in this study exist. Thus the factors affecting quality provided positive feedback. Furthermore, the proposed quality framework is based on findings of a study conducted in regional hospitals within the eThekweni District and as such will be applicable to be used implementation of the framework would be best coordinated from a district level so that consistency of approaches is maintained across the imaging departments in the district. At a hospital level, the Radiography Manager should be the

custodian of the framework and if used effectively it will assist Radiography managers to motivate to hospital management funding for many aspects revealed in this study to be lacking. When applying the framework, it will be important to ensure that customers to imaging departments are well defined and the necessary actions be undertaken to improve satisfaction of customers.

9.5 CHAPTER SUMMARY

Quality in imaging departments can be enhanced by identifying customers to the departments and taking actions to ensure that customers are satisfied with services. Major customers in terms of the quality framework proposed in this study are patients, referrers (mainly doctors) and employees. Aspects to be improved as identified in the current study include staffing, reject analysis, staff development and training, communication, quality control, quality assurance, patient satisfaction, physician satisfaction, equipment, employee satisfaction and NCS. Coordination of the implementation of the framework should be at a district level and Radiography Managers have a key role to play in this aspect.

CHAPTER 10: LIMITATIONS, STRENGTHS, RECOMMENDATIONS AND CONCLUSIONS

10.1 INTRODUCTION

The study set out to establish and explore factors impacting on the provision of quality services in imaging departments within the eThekweni District. The previous chapter was used to design a framework that can be used to improve quality and is drawn from data collection and the conceptual framework. In this chapter certain aspects of the study as identified through the research process are discussed. These aspects include limitations, recommendations for future studies as well as conclusions. Some of the limitations observed occurred at the design phase of the study whilst others were noted at data collection phase. Whilst recommendations are mainly based on data collected, the primary researcher has also made some recommendations based on his experiences and literature. It is envisaged that implementation of the recommendations will result in improvement of quality in imaging departments in the eThekweni District. Furthermore, recommendations will yield better results when applied in any environment with similar characteristics to those revealed in imaging departments in the eThekweni District. In addition, if used for future research these recommendations might yield even better results compared to the current study. In conclusion, recommendations made in this chapter will be of assistance to a range of stakeholders including future researchers, radiographers, radiologists, registrars, Radiography Managers, Hospital Managers and policy planners.

10.2 LIMITATIONS OF THE STUDY

Limitations refer to aspects of a research project that the researcher/s could not investigate (Hoofstee 2013: 87). These aspects might be related to the areas of the study to be investigated, however due to certain shortfalls (for example budget constraints) the researcher might choose not to investigate them.

Limitations in the current study are divided into two broad categories being limitations at the design phase and limitations that emanated at data collection phase. Both categories are discussed below.

10.2.1 Limitations at the design phase

10.2.1.1 Selection of participants

Some of the important stakeholders whose inclusion would have enriched data further were excluded during the study design phase. These include radiologists, registrars, clerks, typists, porters, cleaners, darkroom operators, community service radiographers and student radiographers. Furthermore, other categories of radiographers like the ultrasonographers, Nuclear Medicine radiographers and Radiotherapy radiographers were also excluded. The exclusion of the Nuclear Medicine and Radiotherapy radiographers was based on the fact that their services are more aligned to cancer treatment rather than diagnosis and thus are only available in one of the centres in which data was collected. However, ultrasonographers are a component within the diagnostic imaging department and thus should have been included during data collection. Therefore, whilst the study investigated and explored factors influencing quality in imaging departments, the exclusion of some of the categories within the imaging departments resulted in data focusing mainly on the diagnostic imaging aspect of the departments. However, although imaging is the core business of an imaging department with radiographers and Radiography Managers being the main stakeholders, the exclusion of other support personnel within the departments culminated into incomplete data regarding quality issues within the imaging departments. For this reason, the primary researcher acknowledges that the data obtained could have been strengthened if all stakeholders were involved. However, the data was sufficient to produce a sound framework to improve quality of imaging services within regional hospitals in the eThekweni District of KZN.

10.2.1.2 Limitation of the data collection site

The current study was conducted in public regional hospitals within the eThekweni District. The inclusion of the private hospitals within the eThekweni district would be helpful in providing a comparison of quality issues between the two sectors. It is well known that private imaging departments are better-resourced compared to public hospitals, however both sectors could obtain fundamental lessons to learn from each other.

10.2.1.3 Use of explanatory sequential mixed methods design

The current study employed convergent parallel mixed methods design and thus quantitative and qualitative data were collected concurrently. The quantitative data included a patient satisfaction survey and image reject analysis. Whilst the interviews were conducted with a range of stakeholders, there was no quantitative collection of data from a larger sample representative of the categories interviewed. For this reason, although the study was mixed methods in design and thus should be generalisable to a larger population (Creswell 2014: 40), only the quantitative aspects of the study can be generalised to a larger population. The use of an explanatory sequential mixed methods design would include interviews followed by development of a questionnaire that would then be used to obtain data from a larger sample size thus making it possible to generalise to a larger population.

10.2.2 Limitations at data collection phase

The quantitative strand of the study included an image rejects analysis. The imaging departments from which data was collected largely used computed radiography, while one used digital imaging system with PACS and the other one used wet processing in one section of the department. One of the departments did not conduct reject analysis due to the unavailability of the necessary tools. In the other three imaging departments, image reject analysis results were readily available as a requirement of the SAHPRA Board of the Department of Health. The researcher thus obtained copies of the results that were mostly inherently generated by the processing systems. The system

generated results were based on whether the radiographers provided a reason for rejecting the image and further on what the radiographer believed to be the reason for rejecting an image. The results therefore could have been subjective to a certain degree. For this reason, the researcher should have taken steps to ensure objectivity of the results by viewing all rejected images so as to be certain about the reasons provided by the radiographers. However, the training of radiographers, grounds them in image quality including reject analysis and for this reason it is envisaged that their judgements on reasons to reject images is worth trusting.

10.3 STRENGTHS OF THE STUDY

The study used a mixed- methods design, thus to a certain extent the results and recommendations can be generalised to other imaging departments besides regional hospitals in the eThekweni District. On the other hand, qualitative data yielded were very rich as the researcher was able to explore all aspects quite deeply with perspectives from a range of angles around each aspect. Further to this, the data was collected from a range of stakeholders including patients, doctors, radiographers, Radiography Managers and QA Managers thus providing varying degrees and perspectives of the aspects explored and investigated. The study was the first of its kind to include data collected from such a range of participants. In addition, the sample sizes and the experiences and expertise of the participants in both quantitative and qualitative strands were adequate, thus adding to the richness of data.

10.4 RECOMMENDATIONS

10.4.1 Recommendations by participants

As explained previously, at the time of data collection, there was one regional hospital with PACS in use. The PACS is usually coupled with use of online requisitions, however the interview with doctors revealed that the hospital still used paper-based request forms. The paper-based request form took longer to complete compared to the online requisition thus reducing the doctor-patient contact time. Furthermore, the online request form is empowered with

preloaded options available through the click of a down-arrow. A doctor who worked in an environment in which the online requisitions were a norm expressed that online requisitions save an enormous amount of time and improved the compliance of physicians in completing request forms. For these reasons request forms in hospitals with PACS should be made available on the online platform.

The participants in the current study strongly recommend a speedy transition into the use of PACS by imaging departments. Radiographer participants expressed that conversion to PACS will enhance quality in the provision of service delivery. Participants also recommended regular maintenance of equipment as well as adequate equipping of imaging departments with modalities required for services of regional hospitals. These recommendations were exacerbated by the non-functioning of specialised equipment like fluoroscopy, CT and mammography units in some hospitals. The participants expressed that there were times when certain modalities would be non-functional for a very long time and this resulted in extended backlogs for appointments. Furthermore, some imaging departments procured equipment pieces that were inadequate for the usage at busy regional hospitals. Some of these were floor mounted x-ray tubes instead of ceiling suspended x-ray tubes.

With regards to the improvement of image quality, doctor participants recommended pairing of junior radiographers with senior radiographers to ensure good quality images. This recommendation might not be easy to effect due to staff shortages and high workloads, however intensification of the in-service training programme might be helpful.

Radiographer participants expressed their concerns regarding the absence of documented image acquisition protocols in their departments. Joshi (2009: 106) explains that imaging protocols must be based on the best practices and should include all procedures performed in the department. Amongst the aspects to be included in the image acquisition protocol would be the projections to be performed for each examination requested (for example

posteroanterior (PA) /anteroposterior (AP), oblique, lateral) and patient position (for example recumbent or erect). In cases where CR system is used, the protocol should also direct the radiographer on the film sizes to be used when printing various images and also to what extent multiple images can be printed on one film. Protocols may also be used in the case of specialised examinations like computed tomography (CT), magnetic resonance imaging (MRI) and fluoroscopy.

The absence of image acquisition protocols has far reaching effects on the quality of services provided by an imaging department. When these protocols are absent radiographers and radiologists tend to perform poor quality images as there are no guides for them. In the current study the physicians expressed their dissatisfaction with film sizes used for printing of images while on the other hand radiographers explained that some of their colleagues did not perform all the required projections. It is a basic principle in imaging that at least two projections taken at 90 degrees to each other must be performed. The exceptions for this rule are when a chest x-ray is performed in the ward (Mobile chest x-ray), a single AP abdominal projection to assess kidneys, ureters and bladder (KUB) and in the case of a pelvic image. The reasons for the principle of two images taken at 90 degrees to each other are to avoid superimposition of structures which might result in some pathologic conditions not being clearly visualised, clear localisation of a lesion and lastly to determine the alignment of a fracture. It is clear from this discussion that when some projections are not performed the pathology will not be diagnosed thus the patient will suffer further as the physicians will not be able to adequately manage the patient condition.

It was discovered during data collection that in one of the imaging departments, image reject analysis was not performed. The reason provided was the unavailability of a software package to be used for this purpose. Image reject analysis is a very important tool to be used in advancing image quality in an imaging department and it is thus recommended that means of ensuring that image reject analysis tools are available in all hospitals and should be undertaken.

10.4.2 Recommendations from the findings

It was revealed during data collection that none of the departments had a quality manual. A quality manual should entail amongst other things the quality policy for the imaging department and the scope of services rendered by the imaging department. The availability of such a manual would ensure consistency of actions around maintenance of quality in various aspects in imaging departments. These would include dealing with inconsistencies relating to image reject analysis whereby some departments are not performing it at all, some perform it only as a tick box exercise and some would follow through the results and try to mitigate the challenges exposed. In addition, the concern raised by radiographer participants regarding performance of cold cases after hours would be covered in the scope of services. Further to this there were no set protocols for performance of CT examinations and doctors had to discuss each case with the radiologist prior to its performance. This approach resulted in the waste of precious time for both the referring doctors and radiologists and the presence of a quality manual with the scope of services to be rendered would be used as a guide instead of such necessary consultations. The quality manual needs to be designed with involvement of all staff in the imaging department including radiographers, radiologists, registrars, clerical staff and nursing staff. Input of the internal customers would be very important as well.

It was also discovered during data collection that as much as there were hospital wide QA committees, there were no such committees at departmental level. As stated in Chapter 9, the Departmental Quality Assurance Committee (DQAC) is to ensure that institutional decisions regarding quality initiatives are cascaded down to the departments for implementation. One of the functions of the DQAC will be to communicate institutional decisions on quality improvement to both the departmental management and departmental staff. It is envisaged that once these committees are established in all imaging departments, there will be improvement in consistent application of quality initiatives across the eThekweni District.

There is no unit/structure/ individual dedicated for management of imaging services at district level within the eThekweni District. The absence of such a structure has resulted in the disintegration of services and inconsistencies across the district. Among other duties such a coordinating structure would:

- Monitor the distribution of resources.
- Facilitate application of quality improvement strategies.
- Provide resources for adequate training and development.

Both radiographer and doctor participants in the current study have expressed that there is no reporting of conventional images due to scarcity of radiologists. There are many disadvantages to both patients and doctors resulting from this gap in practice. Doctors have further expressed that interpretation of images takes away the time they would otherwise to consult with patients. Additionally, there is a high possibility that some of the patients are misdiagnosed as doctors are not experts in interpretation of images. The scarcity of radiologists is a worldwide phenomenon and many countries have mitigated it in various ways. For example, in some countries the scope of a radiographer has been extended to include the functions that were originally performed by the radiologists. The researcher in the current study is concerned about exerting an extra burden to already overworked radiographers and recommends training of a new cadre to offer this service. The training would come with its own challenges amongst which would be the amount of time to be taken before noting the effects. However, the primary researcher is of the view that it will be better than not taking any initiative, as the consequences for non-reporting of images are far serious and cannot be left to be the case forever.

Another observation noted during data collection relates to mixing of patients with infectious diseases with those suffering from non-infectious diseases. The need to separate the two categories of patients has been exacerbated by the emergence of the Corona Virus disease which was classified by the World Health Organisation as a pandemic in March 2020. Further to this, countries like Singapore, who experienced other highly infectious diseases like the Severe Acute Respiratory Syndrome (SARS) have ramped up their efforts to

avoid cross infections in future years. The segregation of patients is indeed an expensive exercise, but it is very crucial. In addition, South African has experienced other infectious diseases like Tuberculosis and thus segregation of patients should have been long implemented.

10.5 CONCLUSIONS OF THE STUDY

The primary researcher identified conclusions from both the quantitative and qualitative strands of the study. The findings (illustrated in Table 9.1 of Chapter 9) indicated major factors affecting provision of quality imaging services in the eThekweni District of KZN. Conclusions based on both strands are presented below.

10.5.1 Conclusions from quantitative results

The quantitative strand of the current study involved a patient satisfaction survey using a questionnaire as well as results from image reject analysis.

10.5.1.1 Conclusions from the patient satisfaction survey

Patient were satisfied with many of the aspects investigated in the current study, however there was a significant dissatisfaction with the comfort of the waiting area. Due to the nature of this phase, reasons for this dissatisfaction could not be obtained as responses were not probed. On the other hand, the primary researcher is of the view that this finding could be attributed to lack of televisions/radio, magazines and other instruments usually found in waiting rooms. In addition, patients tend to profile one another and begin to panic when they suspect that one of them could be suffering from an infectious disease.

Another finding worth reporting in this strand was the moderate dissatisfaction of patients with the time they spent in the waiting room. This finding means that radiographers took longer to call patients into the imaging rooms. The qualitative strand provided explanations to this finding as the participants mentioned that there was high workload and shortage of personnel particularly

radiographers and radiologists. In addition, the interviews with radiographers exposed many factors relating to equipment challenges. These range from mere absence of some equipment modalities to lack of maintenance and performance of quality control tests. On a positive note, cleanliness of the department was the most satisfying aspect in imaging departments. This could be attributed to the fact that radiographers stated that they were prepared to clean themselves when cleaners were not on duty.

10.5.1.2 Conclusions from image reject analysis

The current study revealed inconsistencies regarding performance of film/image reject analysis in imaging departments of regional hospitals in the eThekweni District. This included non-performance of the image reject analysis, lack of provision of reasons for rejection of images by radiographers and the extent to which the results were used to improve quality of images in the departments. Furthermore, rate of image rejection was high and main reasons for rejection were related to patients, lack of in-service training and equipment faults. These reasons included inadequacy of position and exposure factors as well as presence of artefacts on images.

10.5.2 Conclusions from the qualitative results

Interviews with radiographers revealed that they did not clearly understand the National Core Standards. Many radiographers claimed that although there were workshops organised, they were not involved due to other commitments. Another finding regarding NCS was that the tool used for inspections was found to be outdated in terms of the language used. On the positive side, the results revealed that all imaging departments performed very well during inspections.

The results further revealed a need to intensify communication between the imaging departments and other units within the hospitals. In addition, communication between doctors and radiographers should be improved. Lack of communication between the two cadres was aggravated by the absence of

protocols for image acquisition and lack of structured in-service training for radiographers. Moreover, the high workload and shortage of radiographers and radiologists were quite severe. The workload was heightened by the access of patients to regional hospital services without following proper referral channels. Furthermore, there were no protocols prescribing imaging studies to be performed after hours, thus imaging departments had to undertake images to all patients referred to the departments regardless of the nature of the condition they were in. The most negative outcome from the shortage of radiologists was the inability of imaging departments to provide reports for conventional studies thus leaving the function of interpreting images to doctors who are not specialists in this regard. With reference to the shortage of radiographers, some hospitals only had one radiographer working after hours. Whilst some of the findings of the current study require interventions at higher levels than that of the RM, it is envisaged that the proposed quality framework will provide solutions to most of the challenges experienced by the imaging department. Furthermore, the influence of RM to hospital management structures will be more beneficial to improvement of quality in the imaging departments.

In summary, the findings reported in the current thesis and the resulting framework are highly relevant to policy and practice particularly in the eThekweni District. The involvement of patients and healthcare professionals in identifying challenges and solutions is a major strength of the current research. Furthermore, the current study has also uncovered the deficiencies in diagnostic imaging services in the eThekweni district around radiographers' knowledge of the National Core Standards. Finally, if implemented, the framework developed can be used to enhance equipment testing and maintenance policies and improve staff and patient satisfaction as well as staff development. These should increase quality in diagnostic imaging services.

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APPENDICES

Appendix 1: Ethical approval from the Institutional Research Ethics Committee



25 September 2019

Mr N P Gam
27 Brisbane Road
Umbilo
Durban
4001

Dear Mr Gam

A quality framework for radiographic service delivery in regional hospitals in the eThekweni District, KwaZulu-Natal.
Ethical Clearance number IREC 118/19

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tools for review.

We are pleased to inform you that the data collection tools have been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letter.

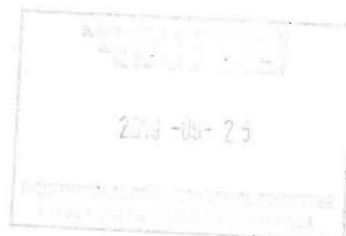
Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC Standard Operating Procedures (SOP's).

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely,

Professor J K Adam
Chairperson: IREC



Appendix 2a: Letter of request for permission to the District Manager

The Office of the Executive Dean
Faculty of Health Sciences
Durban University of Technology
PO Box 1334
Durban
4000
[Date]

The Manager
EThekweni Health District
Highway House
83 Jan Smuts Highway
Mayville
Durban
4001

Request for Permission to Conduct Research

Dear Dr Green

My name is Mr Nkululeko Gam, a PhD student at the Durban University of Technology. The topic of the research I wish to conduct for my Doctoral thesis is: *A quality framework for radiographic service delivery in regional hospitals in the eThekweni District, KwaZulu-Natal.*

I am hereby seeking your consent to allow patients, doctors, Quality Assurance Manager s, and diagnostic radiographers to participate in this study. The data will be collected in regional hospitals in the eThekweni district.

I have provided you with a copy of my proposal which includes copies of the data collection tools, consent form and information letter to be used in the research process, as well as a copy of the provisional ethics clearance which I received from the Institutional Research Ethics Committee (IREC) at the Durban University of Technology.

If you require any further information, please do not hesitate to contact me or my supervisor Prof Sibiya on 031-373 2704 Email nokuthulas@dut.ac.za

Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Nkululeko Gam (Researcher)
Telephone: 031-373 6612
E-mail: nkululekog@dut.ac.za

Appendix 2b: Approval letter from the EThekwini District Manager



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE: CORPORATE SERVICES

83 King Cetshwayo Highway
Mayville, Durban, 4001
Tel: 031 240 5455 Email:
www.kznhealth.gov.za

ETHEKWINI HEALTH DISTRICT OFFICE

19th August 2019

Dear Mr Nkululeko Gam

Re: Permission To Conduct Research at eThekwini District Facilities.

This letter serves to confirm that your application to conduct the research study titled, "**A quality framework for radiographic service delivery in regional hospitals in the eThekwini District, KwaZulu-Natal.**" in the eThekwini district at the following health care facilities has been recommended:

1. Addington Hospital,
2. King Edward VIII Hospital,
3. King Dinuzulu Hospital,
4. Prince Mshiyeni Memorial Hospital and
5. RK Khan Hospital

Kindly upload this letter together with your application as required to the Health Research and Knowledge Unit for the KZN Department of Health for Approval.

Please also note the following:

1. This research project should only commence after final approval by the KwaZulu-Natal Health Research and Knowledge Unit, and full ethical approval, has been granted,
2. That you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
3. All research activities must be conducted in a manner that does not interrupt clinical care at the health care facility,
4. Ensure that this office is informed before you commence your research
5. The District Office/Facility will not provide any resources for this research
6. All logistical details must be arranged with the CEO/medical manager /operational manager of the facility,
7. You will be expected to provide feedback on your findings to the District Office/Facility

Yours sincerely

Dr N Green(District Research Coordinator)
Pp Ms. T. P. Msimango
Chief Director (Acting)
eThekwini Health District

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 3a: Letter of request for permission to the KZN Department of Health

The Office of the Executive Dean
Faculty of Health Sciences
Durban University of Technology
PO Box 1334
Durban
4000
[Date]

The Health Research and Knowledge Management Component
KwaZulu-Natal Department of Health
Private Bag X9051
Pietermaritzburg
3201

Request for Permission to Conduct Research

Dear Dr Lutge

My name is Mr Nkululeko Gam, a PhD student at the Durban University of Technology. The topic of the research I wish to conduct for my Doctoral thesis is: *A quality framework for radiographic service delivery in regional hospitals in the eThekweni District, KwaZulu-Natal.*

I am hereby seeking your consent to allow patients, doctors, Quality Assurance Manager s, and diagnostic radiographers to participate in this study. The data will be collected in regional hospitals in the EThekweni district.

I have provided you with a copy of my proposal which includes copies of the data collection tools, consent form and information letter to be used in the research process, as well as a copy of the provisional ethics clearance which I received from the Institutional Research Ethics Committee (IREC) as well as the support letter from the eThekweni District Manager.

If you require any further information, please do not hesitate to contact me or my supervisor Prof Sibiya on 031-373 2704 Email nokuthulas@dut.ac.za

Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Nkululeko Gam (Researcher)
Telephone: 031-373 6612
E-mail: nkululekog@dut.ac.za

Appendix 3b: Approval letter from the KZN Department of Health



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address: 330 Langalibalele Street, Pietermaritzburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3782
Email: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:

**Health Research & Knowledge
Management**

NHRD Ref: KZ_201908_032

Dear Mr NP Gam
DUT

Approval of research

1. The research proposal titled '**A quality framework for radiographic service delivery in regional hospitals in the eThekwin District, KwaZulu-Natal**' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby **approved** for research to be undertaken at Addington, King Edward, King Dinulu, Prince Mshiyeni Memorial and RK Khan Hospital.

2. You are requested to take note of the following:
 - a. Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.
 - b. Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.
 - c. Provide an interim progress report and final report (electronic and hard copies) when your research is complete to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge

Chairperson, Health Research Committee

Date: 18/09/19

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 4a: Permission letter to the Hospital Manager: Addington Hospital

The Office of the Executive Dean
Faculty of Health Sciences
Durban University of Technology
PO Box 1334
Durban
4000
[Date]

The Hospital Manager
Addington Hospital
Durban
4000

Request for Permission to Conduct Research

Dear Hospital Manager

My name is Mr Nkululeko Gam, a PhD student at the Durban University of Technology. The topic of the research I wish to conduct for my Doctoral thesis is: *A quality framework for radiographic service delivery in regional hospitals in the eThekwin District, KwaZulu-Natal.*

I am hereby seeking your consent to allow patients, doctors, Quality Assurance Manager s, and diagnostic radiographers to participate in this study.

I have provided you with a copy of my proposal together with copies of the data collection tools, consent form and information letter to be used in the research process, as well as copies of the provisional ethics clearance which I received from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology and the approval letter from the KwaZulu-Natal Department of Health.

If you require any further information, please do not hesitate to contact me or my supervisor Prof Sibiyi on 031-373 2704 Email nokuthulas@dut.ac.za

Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Nkululeko Gam (Researcher)
Telephone: 031-373 6612
E-mail: nkululekog@dut.ac.za

Appendix 4b: Approval letter from the Hospital Manager: Addington Hospital



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

ADDINGTON HOSPITAL

P.O. BOX 977
DURBAN
4000
Tel: 031-327-2970 Email: reshma.boodhai@kznhealth.gov.za
www.kznhealth.gov.za

OFFICE OF THE CHIEF EXECUTIVE OFFICER

Reference: 9/2/3/R

Date: 29th August 2019

Principal Investigator:

➤ **Mr NP Gam**

PERMISSION TO CONDUCT RESEARCH AT ADDINGTON HOSPITAL: "A QUALITY FRAMEWORK FOR RADIOGRAPHIC SERVICE DELIVERY IN REGIONAL HOSPITALS IN THE ETHEKWINI DISTRICT, KWAZULU-NATAL"

I have pleasure in informing you that permission has been granted to you by Addington Hospital Management to conduct the above research.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. Addington Hospital will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to Addington Hospital.

**DR M NDLANGISA
HOSPITAL MANAGER
ADDINGTON HOSPITAL**

Appendix 4c: Permission letter to the Hospital Manager: Prince Mshiyeni Memorial Hospital

The Office of the Executive Dean
Faculty of Health Sciences
Durban University of Technology
10 May 2019

The Hospital Manager
Prince Mshiyeni Memorial Hospital
Private Bag X 07
MOBENI
4060

Dear Prof Aung

My name is Mr Nkululeko Gam, a PhD student at the Durban University of Technology. The topic of the research I wish to conduct for my Doctoral thesis is *Developing a Quality Framework for Radiographic Service Delivery in Regional Hospitals in the EThekwin District, KwaZulu-Natal*.

I am hereby seeking your consent to allow patients, doctors, Quality Assurance Managers, and diagnostic radiographers to participate in this study.

I have provided you with a copy of my proposal together with copies of the data collection tools, consent form and information letter to be used in the research process, as well as copies of the approval letters which I received from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology, KwaZulu-Natal Department of Health and a support letter from the eThekwin Health District.

If you require any further information, please do not hesitate to contact me or my supervisor Prof Sibiyi on 031-373 2704 Email nokuthulas@dut.ac.za

Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Nkululeko Gam (Researcher)
Telephone: 031-373 6612
E-mail: nkululekog@dut.ac.za

Appendix 4d: Approval letter from the Hospital Manager: Prince Mshiyeni Memorial Hospital



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE: Senior Medical Manager

Mangosuthu Highway, Private Bag X 07
MOBENI
Tel: 031 907 8317/8304 Fax: 031 906 1044 Email: myint.aung@kznhealth.gov.za
www.kznhealth.gov.za

Prince Mshiyeni Memorial
Hospital

Enquiry: Dr M AUNG
Ref No: 43/RESH/2019
Date: 17/10/2019

TO: Mr Nkululeko Gam

RE: LETTER OF SUPPORT TO CONDUCT RESEARCH AT PMMH

Dear researcher;

I have pleasure to inform you that PMMH has considered your application to conduct research on **“A quality framework for radiographic service delivery in regional hospitals in the eThekweni District, KwaZulu-Natal”** in our institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. The institution will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to the institution.

Should the following requirements be fulfilled, a Permission/ Approval letter will follow.

- Full research protocol, including questionnaires and consent forms if applicable.
- Ethical approval from a recognized Ethic committee in South Africa

Thank you.

MYINT AUNG

Senior Medical Manager & specialist in Family Medicine
MBBS, DO(SA), PGDip in HIV (Natal), M.Med.Fam.Med (natal), PhD
Tel: 031 9078317
Fax: 031 906 1044
myint.aung@kznhealth.gov.za

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 4e: Permission letter to the Hospital Manager: R K Khan Hospital

The Office of the Executive Dean
Faculty of Health Sciences
Durban University of Technology
10 May 2019

The Hospital Manager
R K Khan Hospital
Private Bag X 004
CHARTSWORTH
4030

Request for Permission to Conduct Research

Dear Dr Subban

My name is Mr Nkululeko Gam, a PhD student at the Durban University of Technology. The topic of the research I wish to conduct for my Doctoral thesis is *Developing a Quality Framework for Radiographic Service Delivery in Regional Hospitals in the EThekweni District, KwaZulu-Natal*.

I am hereby seeking your consent to allow, patients, doctors, Quality Assurance Manager s, and diagnostic radiographers to participate in this study.

I have provided you with a copy of my proposal together with copies of the data collection tools, consent form and information letter to be used in the research process, as well as copies of the approval letters which I received from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology, KwaZulu-Natal Department of Health and a support letter from the eThekweni Health District.

If you require any further information, please do not hesitate to contact me or my supervisor Prof Sibiya on 031-373 2704 Email nokuthulas@dut.ac.za

Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Nkululeko Gam (Researcher)
Telephone: 031-373 6612
E-mail: nkululekog@dut.ac.za

Appendix 4f: Approval letter from the Hospital Manager: RK Khan Hospital



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address : R.K. Khan Circle
Physical Address : CHATSWORTH
Tel: [031] 4596001 Fax:[031] 4011247 Email:Dianne.naicker@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:

R.K. KHAN HOSPITAL
OFFICE OF THE CEO

ENQUIRIES: DR D. BEHADAR

20 NOVEMBER 2019

MR NKULULEKO PHALSON GAM
27 Brisbane Road
Umbilo
Durban
4001

Dear Mr Gam

RE: PERMISSION TO CONDUCT RESEARCH: A QUALITY FRAMEWORK FOR RADIOGRAPHIC SERVICE DELIVERY IN REGIONAL HOSPITALS IN THE ETHEKWINI DISTRICT, KWAZULU-NATAL

Permission is granted to conduct the study at this institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures protocols and guidelines of the Institution with regards to this research.
2. Please ensure this office is informed before you commence your research and your University's Ethics approval must be attached.
3. **You will be expected to provide feedback on your findings to this institution.**
4. You will be liaising with: Mr Selvam Pillay
Radiography Manager
Tel: [031-4596130]

Yours faithfully

DR D. BEHADAR
MANAGER: MEDICAL SERVICES
/SN

Appendix 4g: Permission letter to the Hospital Manager: King Dinizulu Central Hospital

The Office of the Executive Dean
Faculty of Health Sciences
Durban University of Technology
[Date]

The Hospital Manager
King Dinuzulu Hospital Complex
P O Box Dormerton
DORMERTON
4015

Request for Permission to Conduct Research

Dear Dr Naidu

My name is Mr Nkululeko Gam, a PhD student at the Durban University of Technology. The topic of the research I wish to conduct for my Doctoral thesis is *Developing a Quality Framework for Radiographic Service Delivery in Regional Hospitals in the EThekwin District, KwaZulu-Natal*.

I am hereby seeking your consent to allow, patients, doctors, Quality Assurance Manager s, and diagnostic radiographers to participate in this study.

I have provided you with a copy of my proposal together with copies of the data collection tools, consent form and information letter to be used in the research process, as well as copies of the approval letters which I received from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology, KwaZulu-Natal Department of Health and a support letter from the eThekwin Health District.

If you require any further information, please do not hesitate to contact me or my supervisor Prof Sibiyi on 031-373 2704 Email nokuthulas@dut.ac.za

Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Nkululeko Gam (Researcher)
Telephone: 031-373 6612
E-mail: nkululekog@dut.ac.za

Appendix 4h: Approval letter from the Hospital Manager: King Dinizulu Central Hospital



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address :75 R.D. Naidu road, Sydenham
Physical Address:PO Dormerton, 4015
Tel: 031 242 6000 Fax: 031 2099586
Email address:shamin_maharaj@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:

King Dinuzulu Hospital Complex

Enquires: Dr S.B. Maharaj

Date: 31 October 2019

Dear Mr N. Gam

RE: PERMISSION TO CONDUCT RESEARCH "A QUALITY FRAMEWORK FOR RADIOGRAPHIC SERVICE DELIVERY IN REGIONAL HOSPITALS IN THE ETHEKWINI DISTRICT, KWAZULU-NATAL".

I have pleasure in informing you that permission to conduct the above study has been granted to you by King Dinuzulu Hospital Complex.

Please note the following:

1. Please ensure that you adhere to all policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. Please ensure that this office is informed before you commence your research.
3. Neither the District Office nor KDHC will provide any resources for this research.
4. Your attention is drawn to the maintenance of confidentiality with respect to staff records/files and may not be removed from this Institution.
5. You will be expected to provide feedback on your findings to KDHC.

Yours sincerely

DR S. B. Maharaj
MEDICAL MANAGER
KDHC

Appendix 5a: Letter of Information for survey participants



Dear Participant

Thank you for agreeing to participate in this study.

Title of the Research Study: *A quality framework for radiographic service delivery in regional hospitals in the eThekweni District, KwaZulu-Natal.*

Principal Investigator/s/researcher: Mr Nkululeko Phalson Gam, PhD: Health Sciences Candidate.

Co-Investigator/s/supervisor/s: Prof M.N. Sibiya, D Tech: Nursing (Supervisor) and Prof C.C. Jinabhai, PhD (Co-supervisor).

Brief Introduction and Purpose of the Study: The aim of the study is to explore the factors affecting quality in diagnostic imaging departments with the view to develop a framework that can be used to improve quality in the imaging departments within the eThekweni District. As a health professional who provides radiography services in regional hospitals, it is envisaged that you will be able to share your experiences with regard to quality and suggest any actions that need to be undertaken to enhance quality of care.

Outline of the Procedures: You are kindly requested to share information by participating with the researcher and his assistant. You are kindly requested to participate in the survey by responding to all the questions to determine your satisfaction about the services in the X-Ray department. The questionnaire will take you approximately 30 minutes to complete. I will personally distribute and collect the

questionnaire. A box will be made available for you to deposit the completed questionnaire.

Risks or Discomforts to the Participant: There are no foreseeable risks or harm to you that will be imposed by the research study. As a participant you can choose to withdraw from the study at any time without.

Benefits: The intention of the study is to improve the quality of care in imaging departments within the eThekweni district. This in turn will improve turnaround times for reporting, improvement of images and comfort during stay in the X-Ray department.

Reason/s why the Participant May Be Withdrawn from the Study: You will not be advantaged or disadvantaged in any way should you choose to participate or not to participate in this study. A participant will be withdrawn from the study if they fail to sign and return the consent form. You may choose at any time to withdraw from the study as there is no obligation to complete the study. Should you decide to withdraw from the study after you have completed the questionnaire, please feel free to contact the researcher and your data will be destroyed at your request.

Remuneration: You will not receive any monetary gift or remuneration of any kind for participation in this research study.

Costs of the Study: You do not pay anything to participate in the study.

Confidentiality: All information and data will be kept strictly confidential. All interview transcripts will be coded to facilitate recording but no names will be written on them. The list of participant's names and their corresponding research number will be locked away in the filing cabinet with the researcher only having access to it. Transcripts will be kept in a fireproof locked filing cabinet with the researcher being the only person having access to it. The consent page will be removed from the information letter and locked away in the filing cabinet to prevent linkage of the participants to their transcripts. This will be done to maintain strict confidentiality. The data will be

captured on spread sheets on the researcher's computer. The computer will be secured by password protection. Back up of data will be on a memory stick which will be kept in a locked filling cabinet. The supervisor will only have access to the anonymous individual data on the researcher's computer and therefore will not be able to link the participant to their responses. The research data, questionnaires and any other confidential information will be kept for five years thereafter it will be destroyed by the researcher.

Research-related Injury: There is no anticipated research-related injury by participating in the study.

Persons to Contact in the Event of Any Problems or Queries: If you have any questions, concerns or problems at any time about the study or the procedures feel free to contact the researcher, Mr Nkululeko Gam at 073 755 5563, or 031-373 6612 (W) or via email at nkululekog@dut.ac.za or my supervisor Prof M.N. Sibiya at 031-373 2704. If you have any questions or concerns about ethical issues or your rights, or feel you have not been treated according to the descriptions in this letter, or your rights as a participant in research are being violated during the course of this study please feel free to contact the Institutional Research Ethics administrator on 031-373 2375. Complaints can be reported to the DVC: Research, Innovation and Engagement Prof S Moyo on 031-373 2577 or moyos@dut.ac.za.

Isandiso 5b: Incwadi yokunika ulwazi eya kubahlanganyeli bocwaningo



Isihloko socwaningo: Ukusungula umhlahlandlela wekhwaliti yokuhlinzekwa kwezidingo zocwaningo lwex-ray ezibhedlela zesifundazwe esifundeni saseThekwini KwaZulu-Natal.

Umcwaningi omkhulu: Mnuz Nkululeko Phalson Gam, Umfundi weziqu zobudokotela kumkhakha wezempilo.

Ababheke umcwaningi: USolwazi M.N. Sibiya, Uneziqu zobudokotela kanye no Prof C.C. Jinabhai, Uneziqu zobudokotela.

Isingeniso: Ngikumememela ukuthi ubambe iqhaza kucwaningo engizokulenza kwesi sibhedlele. Inhloso yocwaningo oluhlongozwayo ukuthola izici ezithinta izinga lokulethwa kwezidingo eminyangweni yex-ray ezibhedlela zesifundazwe esifundeni saseThekwini kwaZulu-Natal. Njengesiguli esakhe sasezinsizakalweni se x-ray, kulindeleke ukuthi uzokwazi ukwabelana ngamava akho mayelana nekhwaliti yalezi zinsizakalo.

Uhlaka lokuzakwenziwa: Uyacelwa ukuba wabelane ngolwazi ngokuhlanyela nomcwaningi nomsizi wahke. Isikhathi esingasichitha singaba Phakathi kwengxenywe yehora nesigamu ukuya kwihora elilodwa. Ngicela ufunde lencwadi uyizwe ubuze kumcwaningi uma ungaqondi kahle bese ushicelela isivumelwano sokuvuma ukuthi uyathanda ukuba yingxenywe yocwaningo ngokuba kukhulunywe nawe futhi kuqoshwe inkulumo Phakathi kwakho nomcwaningi.

Amathuba okungaphatheki kahle: Awekho amathuba okuzizwa ungaphathekile kahle ngoba ngizokhuluma nawe kuphela ngeke ngikwenze lutho.

Inzuzo: Ayikho inzuzo ngalolucwaningo ezotholwa nguwe kodwa imiphumela yolucwaningo ingasiza iziguli nabaphathi ngolwazi abangaisebenzisela ukuthuthukisa izidingo kwiminyango yex-ray.

Izizathu zokuhoxiswa kulolucwaningo: Ungakwazi ukunqaba ukukhuluma nami noma ukuqoshwa kwenkulumo. Futhi lokho ngeze kubenemiphumela emibi kuwena.

Iholo: Ayikho imali etholakalayo ngokuba ingxenye yocwaningo.

Izindleko zocwaningo: Zonke izindleko zocwaningo zibhekene name njengomcwaningi, akukho lutho obhekeke ukuthi ulukhokhe wena.

Imfihlo: Amagama abantu awazusetshenziswa kulolucwaningo. Ngizoba nendlela eyimfihlo yokukhombisa ukwehlukana kwababambe iqhaza kulolucwaningo njengokubhala inombolo esikhundleni segama.

Ukulimala okungenziwa ucwaningo: Akukho kulimala okungenziwa ucwaningo njengoba ngizobe ngikhuluma nawe kuphela kungekho lutho oluzokwenziwa kuwena. Uma uzizwa uba nokuphazamiseka ngokomoya emva kokuphendula imibuzo nokukhuluma nami ngicela ungitshele. Ngizokuthumela kumeluleki oqeqeshiwe ukuze akusize.

Ongabathinta uma kunenkinga noma kukhona ofisa ukubuza: Thintana name uMnumzane uN.P. Gam kulenombolo yocingo: 031-373 6612 noma umqaphi wocwaningo uSolwazi M.N. Sibiya kulenombolo: 031-373-2703. Unakho nokuthinta obhekelele ukuvikeleka kocwaningo lwabafundi benyuvesi uSolwazi Moyo kulenombolo: 031-373 2577.

Appendix 6a: Informed consent (English)



Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Mr Nkululeko Phalson Gam about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Full Name of Participant **Date** **Time** **Signature** /
Right Thumbprint

I, Nkululeko Phalson Gam herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Nkululeko P.Gam _____ _____

Full Name of Researcher **Date** **Signature**

Full Name of Witness (If applicable) Date

Signature

Full Name of Legal Guardian (If applicable) Date

Signature

Appendix 6b: Consent (IsiZulu)



Isitatimende sesivumelwano sokubamba iqhaza kucwaningo lwesifundo:

- Ngiaqinisekisa ukuthi ngazisiwe umcwaningi, u Mnuz. Nkululeko Phalson Gam ngohlobo, izinzuzo, ubungozi bocwaningo - Research Ethics Clearance Number: _____,
- Nginikeziwe, ngayifunda, ngayiqonda imininingwane ebhalwe ngenhla (Participant Letter of Information) mayelana nocwaningo.
- Ngiaqonda ukuthi imiphumela yocwaningo (isifundo), okubalwa kuyo ubulili bami, iminyaka yami, usuku lokuzalwa, ama-inishela ami noxilongo kuzocwaningwa/ kuzasetshenzwa ngokuyimfihlo.
- Ngokubuka izidinga zocwaningo, ngiyavuma ukuthi imininingwano eqoqiwe ingacwaningwa nge computer.
- Noma inini ngingahoxa ekubeni ingxenye yocwaningo yalesifundo ngaphandle kokubandlululwa.
- Ngibe nesikhathi esanele sokubuza imibuzo yingakho ngizivumela ngokwami ukuthi ngilungiselelwe ukubamba iqhaza kulesifundo.
- Ngiaqonda ukuthi okutholakalayo okusha okusemqoka kulolucwaningo okuthinta mina ngizokwaziswa.

Igama Lobambiqhaza
Isithupha Sokudla

Usuku

Isikhathi

Ukusayina/

Mina, Nkululeko P.Gam ngiaqiniseka ukuthi umbambi qhaza obhalwe ngenhla wazisiwe ngokugcwele ngohlobo nobungozi balesisifundo.

Igama lomcwaningi

Usuku

Ukusayina

Igama lafakazi (If applicable)

Usuku

Ukusayina

Igama lombheki osemthethweni (If applicable) Usuku

Ukusayina

Appendix 7a: Questionnaire for patient satisfaction survey in Diagnostic Imaging Departments

Please indicate your answers by placing a cross (X) in the appropriate box:

A. DEMOGRAPHIC INFORMATION

1. Age in years

18 – 20	21 – 30	31 – 40	41 – 50	51 – 60	Above 60

2. Gender

Male	Femal

3. Patient status

In Patient	Out patient

4. Marital status

Single	Married	Divorced/ separated	Widowed

5. Highest level of education

Some/all Primary school	Some/all High School	Degree/ Diploma	Postgraduate degree

6. Occupational status: Please select the **ONE** option that applies best to you.

Employed	Unemployed/ student	Self-employed	Retired

7. Indicate the type of work you do (Select the **ONE** option that best applies to you)

Professional / Skilled job	Labourer/ unskilled job	Trader	Security sector	Clerk /Machine operator	Other: Specify _____
					—

8. Type of examination conducted: (Select the **ONE** option that applies to your current visit)

General x-rays	CT	MRI	Fluoroscopy	Mammo-graphy	Biopsy	Dental	Other

B. LEVEL OF SATISFACTION

Indicate your agreement with the following statements regarding your experience in the X-Ray Department:

Statements	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1 I was consulted regarding the date and time at which my appointment was scheduled.						
2 I was attended to by the medical personnel near to the time of my scheduled appointment						
3 Locating the department in the hospital is easy						
4 I was greeted by a friendly receptionist at reception						
5 The reception area is clean.						
6 I feel safe in the reception area						
7 The time I spend waiting for my radiography related services impacts on my income and/or business						
8 There are clear instructions to patients (e.g. where to place one's medical cards or folders) at reception						
9 I am satisfied with the length of time I was in the waiting area						
10 I am satisfied with the length of time that the procedure took.						
11 I am satisfied with the professionalism / friendliness						

	of radiographer/ radiologist/ doctor.						
12	I am satisfied with the explanation I was given regarding the examination/ procedure I was receiving.						
13	I was given adequate privacy during my procedure.						
14	I am satisfied with the cleanliness of the x-ray department.						
	Statements	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
15	Overall, I am impressed with the staff						
16	Generally, the staff are caring						
17	I was given information on where and when to collect my results.						
18	I was able to understand and communicate with all hospital personnel (by using an interpreter if necessary).						
19	The air temperature in the x-ray department (including waiting room, x-ray room and corridor) was comfortable.						
20	I am satisfied with the overall comfort of the waiting area (e.g. available magazines to read; TV to watch; comfortable chairs).						
21	I am satisfied with the cleanliness of the waiting area.						

22	I am satisfied with the cleanliness of the linen.						
23	I am satisfied with the comfort of the x-ray bed.						
24	Overall, I am impressed with the service delivery in the X-ray department.						
25	I was provided with radiation protection apparel (e.g. a lead apron for protection from ionising radiation).						

THANK YOU FOR YOUR TIME

Isandiso 7b: Imibuzo yokwaneliseka kweziguli kumnyango weX-Ray

Sicela ubonise impendulo yakho ngokubeka u"X" kwindawo efanele.

C. IMINININGWANE EMAYELA NAWU

1. Iminyaka yobudala bakho

18 – 20	21 – 30	31 – 40	41 – 50	51 – 60	Above 60

2. Ubulili

Owesilisa	Owesifazane

3. Ubume besiguli

Ulalisiwe	Usek haya

4. Isimo somshado

Akushadile	Ushadile	Uhlukanisile	Umfelwa	Umfelwakazi

5. Izinga lemfundo eliphakeme

Isikole sebanga eliphansi	Isikole sebanga eliphezulu	Iziqu	IPostgraduate

6. Isimo sokusebenza

Uqashiwe	Akusebenzi	Uziqashile	Umhlalaphansi

7. Uhlobo lomsebenzi owenzayo

Uchwepheshe/ unekhono	Umsebenzi ongafundile	Umthengisi	Umkhakha wokuphepha	Unobhala/ Umsebenzi womashini	Okunye: Kubhale apha _____

8. Uhlobo lohlobo olwenziwe

X-ray jikelele	CT	MRI	Fluoros-copy	Mammo-graphy	Biopsy	Dental	Okunye

2 IZINGA LOKWANELISEKA

Sicela ukhombise izinga lokwanela kwakho kumnyango we X-Ray ngokuthi ubonise ukuvumelana kwakho noku kubhalwe ngezansi.

Isitatimende	Phikisa kakhulu	Phikisa	Nginyaphi ka kancane	Nginyavu melana kancane	Nginyavu ma	Nginyavu melana kakhulu
1. Ngaxoxwa mayelana nosuku nesikhathi lapho						

ngangizokuza kumnyango we X-ray.						
2. Ngifike ngesikhathi enganikwa sona bese bashesha bangisiza.						
3. Kulula ukuthola umnyango wase X-ray.						
4. Ngamkelwa ngezandla ezifudumele kwindawo yokubhalisa.						
5. Indawo yokulindela ihlanzekile.						
6. Ngizizwe ngikhuselekile endaweni yokulindela.						
7. Isikhathi engasilinda sinomthelelo emholweni wami.						
8. Imiyalelo esendaweni yokulindela icacile.						
9. Ngithokozile ngesikhathi engasilinda endaweni yokulindela.						
10. Ngithokozile ngesikhathi Abasithatha benza uhlolo.						
11. Ngigcolisekile ngemfudumalo nesenzo sobungane beradiographer kunye nodokotela wase X-Ray.						
12. Ngithokozile ngencazelo engayithola ngohlolo engangizolenza.						
13. Nganikezwa ubumfihlo obanele ngesikhathi ngikumnyango we X-Ray.						
14. Ngigcolisekile ngokuhlangeka komnyango wase X-Ray.						
Isitatimende	Ngiyaphi ka kakhulu	Ngiyaphi kisa	Ngiyaphi ka kancane	Ngiyavu melana kancane	Ngiyavu ma	Ngiyavu melana kakhulu
15. Ngiyathokoza ngabasebenzi bomnyango wase X-Ray jikele.						
16. Ngithokozile ngokunakekelwa abasebenzi.						
17. Nganikezwa ulwazi mayelana nokuthola imiphumela yohlolo.						
18. Kwakululwa ukuqonda nokuxhumana nabo bonke abasebenzi.						
19. Izinga lokubanda nokushisa lwalamkelekile.						

20. Ngithokozile ngendawo yokulindela (Isibonelo kukhona izincwadi zokufunda/ amaphephandaba; umabonakude; Kanye nezitulo ezintofontofo).						
21. Ngithokozile ngokuhlanzeka kwendawo yokulindela.						
22. Ngithokozile ngokuhlanzeka kwezindwangu zombhede.						
23. Ngithokozile ngobuntofontofo bombhede.						
24. Ngithokozile jikelele ngokulethwa kwezidingo kumnyango we X-Ray.						
25. Nganikekwa okufanelwe ngokohlelo ukuvikela irradiation.						

NGIYABONGA NGESIKHATHI SAKHO

Appendix 8: Tool used for image reject analysis

REJECT FILM/IMAGE ANALYSIS

Period: From.....To:..... Total number of films or images produced:..... Total number of rejected films/images:..... Percentage of rejected films/images:.....

REASON	NUMBER OF FILMS PER EXAMINATION										TOTAL	%AGE
	PA Chest	Lateral Chest	Upper extremity	Lower extremity	Abdomen	Pelvis	Child	CT	Fluoro	Mammo		
Exposure												
Positioning												
Centring												
Patient motion												
Fog – Image receptor												
Fog - darkroom												
Static												
Artefact												
Mechanical												
Good film/image												
Noise												
Total												
Percentage												

Adapted from WHO Workbook for Radiographers (WHO 2001)

Appendix 9: Letter of Information for interview participants



Dear Participant

Thank you for agreeing to participate in this study.

Title of the Research Study: *A quality framework for radiographic service delivery in regional hospitals in the eThekweni District, KwaZulu-Natal.*

Principal Investigator/s/researcher: Mr Nkululeko Phalson Gam, PhD: Health Sciences Candidate.

Co-Investigator/s/supervisor/s: Prof M.N. Sibiya, D Tech: Nursing (Supervisor) and Prof C.C. Jinabhai, PhD (Co-supervisor).

Brief Introduction and Purpose of the Study: The aim of the study is to explore the factors affecting quality in diagnostic imaging departments with the view to develop a framework that can be used to improve quality in the imaging departments within the eThekweni District. As a health professional who provides radiography services in regional hospitals, it is envisaged that you will be able to share your experiences with regard to quality and suggest any actions that need to be undertaken to enhance quality of care.

Outline of the Procedures: You are kindly requested to share information by participating with the researcher and his assistant. I will ask you a few questions regarding radiographic quality and this will take no more than 45 minutes. You are kindly requested to participate on one-to-one interview session. Face to face interview will be conducted at the venues date and time that will suit you. The interview discussion

will be facilitated by the researcher. For record purposes, I kindly request to record the discussion by using a voice recorder.

Risks or Discomforts to the Participant: There is no anticipated risks or discomfort by participating in the study.

Benefits: The intention of the study is to improve processes involved in diagnosis of various conditions in the eThekweni district and this will assist in enhancing quality of care in radiography departments. Improving quality of imaging services will improve speed in diagnosis, improve adequacy of diagnosis and reduce radiation dose to patients, radiation workers and the public.

Reason/s why the Participant May Be Withdrawn from the Study: You will not be advantaged or disadvantaged in any way should you choose to participate or not to participate in this study. A participant will be withdrawn from the study if they fail to sign and return the consent form. You may choose at any time to withdraw from the study as there is no obligation to complete the study. Should you decide to withdraw from the study after you have been interviewed, please feel free to contact the researcher and your data will be destroyed at your request.

Remuneration: You will not receive any monetary gift or remuneration of any kind for participation in this research study.

Costs of the Study: You do not pay anything to participate in the study.

Confidentiality: All information and data will be kept strictly confidential. All interview transcripts will be coded to facilitate recording but no names will be written on them. The list of participant's names and their corresponding research number will be locked away in the filing cabinet with the researcher only having access to it. Transcripts will be kept in a fireproof locked filing cabinet with the researcher being the only person having access to it. The consent page will be removed from the information letter and locked away in the filing cabinet to prevent linkage of the participants to their transcripts. This will be done to maintain strict confidentiality.

The data will be captured on spread sheets on the researcher's computer. The computer will be secured by password protection. Back up of data will be on a memory stick which will be kept in a locked filing cabinet. The supervisor will only have access to the anonymous individual data on the researcher's computer and therefore will not be able to link the participant to their responses. The research data, questionnaires and any other confidential information will be kept for five years thereafter it will be destroyed by the researcher.

Research-related Injury: There is no anticipated research-related injury by participating in the study.

Persons to Contact in the Event of Any Problems or Queries: If you have any questions, concerns or problems at any time about the study or the procedures feel free to contact the researcher, Mr Nkululeko Gam at 073 755 5563, or 031-373 6612 (W) or via email at nkululekog@dut.ac.za or my supervisor Prof M.N. Sibiya at 031-373 2704. If you have any questions or concerns about ethical issues or your rights, or feel you have not been treated according to the descriptions in this letter, or your rights as a participant in research are being violated during the course of this study please feel free to contact the Institutional Research Ethics administrator on 031 373 2375. Complaints can be reported to the DVC: Research, Innovation and Engagement Prof S Moyo on 031 373 2577 or moyos@dut.ac.za.

Appendix 10a: Interview guide for radiographers

PART 1: DEMOGRAPHIC DATA

Participant Code:

Hospital Code:

Date of interview:

Please answer the following questions in the spaces provided by placing X in the most appropriate option.

1. Gender:

1. Male	<input type="text"/>
2. Female	<input type="text"/>
3. Other	<input type="text"/>

2. Age in years:.....

3. Year of experience as radiographers:.....

4. Race:

5. Highest qualification:

6. Current position:

7. Years of experience:

8. Hospital:

PART 2: SERVICE QUALITY

- What does the term service quality mean to you?
- What are your views on the quality of service delivery in radiography?
- What factors do you think positively affect service quality in radiography patients?
- What are the stumbling blocks for you to offer good service quality to patients?
- According to your experience in radiographic imaging, how are the standards of care monitored and enhanced in imaging service delivery?
- What do you understand by quality assurance in your department?

- What do you think are the main contributors to repetition of imaging examinations in your x-ray department?
- In your experience, what are the main complaints reported by the patients?
- In your experience, how are patient complaints about waiting times handled?
- What are your views regarding the patient waiting times?
- What do you understand by the National Core Standards?
- The Clinical Support services domain of the National Core Standards covers specific services essential in the provision of clinical care and include the timely availability of medicines and efficient provision of diagnostic, therapeutic and other clinical support services and necessary medical technology, as well as systems to monitor the efficiency of the care provided to patients.
- In your opinion, does the clinical annual relicensing inspection by the Department of Health include any of the above aspects related to the clinical domain of the NCS?

Appendix 10b: Interview guide for doctors

PART 1: DEMOGRAPHIC DATA

Participant Code:

Hospital Code:

Date of interview:

Please answer the following questions in the spaces provided by placing X in the most appropriate option.

1. Gender:

1. Male	<input type="text"/>
2. Female	<input type="text"/>
3. Other	<input type="text"/>

2. Age in years:.....

3. Year of experience as a doctor:.....

4. Race:

5. Highest Qualification:

6. Current Position:

7. Years of experience:

8. Hospital:

9. Area of specialisation:.....

PART 2: INTERVIEW GUIDE

Grand tour question

In your opinion, is the quality of imaging services in this hospital of an acceptable quality?

Probes

- Do you receive reports in all cases that you refer for imaging?

- Are the reports received in good time?
- Do you usually receive complaints from your patients regarding their treatment in the X-Ray department?
- Do you usually experience delays in imaging of your patients?
- What would be your general comment about the quality of the images?
i.e clarity, positioning, adequacy of views or projections and protocols.

Are you clear about protocols to be followed when requesting services of the X-Ray department?

Probes

- Is there a request form to be completed for all imaging services?
- What are your opinions about the clarity of the request form?

What are the other areas that need improvement in the X-Ray department?

Probe

- List three main areas that you think need urgent improvement.

Appendix 10c: Interview guide for Radiography Managers

PART 1: DEMOGRAPHIC DATA

Participant Code:

Hospital Code:

Date of interview:

Please answer the following questions in the spaces provided by placing X in the most appropriate option.

1. Gender:

1. Male	<input type="text"/>
2. Female	<input type="text"/>
3. Other	<input type="text"/>

2. Age in years:.....

3. Year of experience as radiographers:.....

4. Race:

5. Highest qualification:

6. Current position:

7. Years of experience as a radiographer:.....

8. Years of experience as a manager:.....

9. Hospital:

PART 2: SERVICE QUALITY

What does the term service quality mean to you?

Probe: What are your views on the quality of service delivery to patients in your department?

What do you think influences the quality of service that the department renders to patients?

Can you please comment on patient waiting times?

Probe: How are patient complaints about waiting times handled?

What are the stumbling blocks for the radiographers to offer good service quality to patients?

Probe: What measures do you have in place to maximise the quality of service delivery to patients?

According to your experience in radiographic imaging, how are the standards of care monitored and enhanced in imaging service delivery?

What do you understand by quality assurance in your department?

What do you think are the main contributors to repetition of imaging examinations in your x-ray department?

The current level of the rejection rate in your department is currently higher than that recommended by the WHO. How can this be reduced?

How do you think workload in your department affects this?

Probe: How do you think workload increase will affect this?

In your experience what are the main complaints reported by the patients?

What do you understand by the National Core Standards?

The Clinical Support services domain of the National Core Standards covers specific services essential in the provision of clinical care and include the timely availability of medicines and efficient provision of diagnostic, therapeutic and other clinical support services and necessary medical technology, as well as systems to monitor the efficiency of the care provided to patients.

In your opinion, does the clinical annual relicensing inspection by the Department of Health include any of the above aspects related to the clinical domain of the National Core Standards?

Appendix 10d: Interview guide for Quality Assurance Managers

PART 1: DEMOGRAPHIC DATA

Participant Code:

Hospital Code:

Date of interview:

Please answer the following questions in the spaces provided by placing X in the most appropriate option.

1. Gender:

1. Male	<input type="text"/>
2. Female	<input type="text"/>
3. Other	<input type="text"/>

2. Age in years:.....

3. Profession/Discipline:.....

4. Race:

5. Highest Qualification:

6. Current Position:

7. Years of experience in profession/discipline:.....

8. Years of experience as Quality Manager:.....

9. Hospital:

PART 2: SERVICE QUALITY

What are your views on the quality of service delivery in radiography?

What are the main factors that you think affect service quality in radiography?

Probing questions

- In your experience what are the main complaints reported by the clients regarding the radiography services?
- In your experience, how are the complaints handled?

Are you satisfied with the scores obtained by the X-Ray department during the licencing inspections?

Probing questions

- Please provide overall scores for inspections in the X-Ray department for the past three years.
- What are the main challenges affecting quality of care in the X-Ray departments?

In your opinion what should be done to improve quality in the X-Ray department?

Appendix 11: Questionnaire for validation of the proposed practice framework

VALIDATION OF THE PROPOSED PRACTICE FRAMEWORK

1. Comment on the ability of the framework in addressing factors affecting quality of services within the diagnostic imaging departments.

2. Comment on the inclusiveness of the framework in dealing with factors affecting quality of services within the diagnostic imaging departments.

3. Comment on the applicability of the framework in diagnostic imaging services within the eThekweni district.

4. Comment on any concerns that you may have with regards to the proposed framework.

Appendix 12: Letter from the statistician

Gill Hendry B.Sc. (Hons), M.Sc. (Wits), PhD (UKZN)
Mathematical and Statistical Services

Cell: 083 300 9896
email: hendryfam@telkomsa.net

11 June 2019

Re: Assistance with statistical aspects of the study

Please be advised that I have assisted Nkululeko Phalson Gam (Student number 20926758), who is presently studying for a PhD: Health Sciences at DUT, with the sampling as well as the development and validation of the questionnaire for his study.

Yours sincerely

Gill Hendry (Dr)

Appendix 13: Letter from the professional editor

DR NELLIE NARANJEE: LECTURER

Doctorate Nursing, MBA, MCur (Health Sciences)
Freelance academic editor: Blackford Institute, UK

28 Protea Road
Kloof
3610

Contact details

Office : 031 3732036
After hours : 031 7643815
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Email naranjeen@gmail.com
NellieN1@dut.ac.za

EDITING / PROOFREADING CERTIFICATE

Re: Nkululeko Phalson Gam (20926758)

**Masters/Doctoral thesis: A Quality Framework for Radiographic Service
Delivery in Regional Hospitals in the Ethekwini District Of Kwazulu-
Natal, South Africa**

I confirm that I have edited this thesis for writing style, clarity, language, sentence structure and layout. The document is formatted according to the prescribed guidelines. I returned the document to the author with track changes. The author remains responsible for the correct application of the changes in the text and references.

I am a freelance editor specialising in proofreading and editing of academic documents. I have a Doctorate Degree in Nursing from Durban University of Technology. I have a Master's Degree in Business Administration (Public Health) and a Master's Degree in Health Sciences. I have a Diploma in Proofreading and Copy Editing with Distinction from the Blackford Institute, UK. I have supervised numerous Master's degree dissertations.

I wish Mr Rugut all the best.

28 October 2020

DR NELLIE NARANJEE

DATE

Appendix 14: Sample of a transcript

DOCTOR 1: HOSPITAL A

Researcher: *When we talk of the x-ray department what do you expect in terms of quality?*

Participant: *Mhhh in terms of quality we have a lot of investigation that we require. So when we talk of x-ray in terms of my understanding there are emergency andthat is my understanding.*

Researcher: *In terms of this department here at(Hospital A) what do you think their quality is like?*

Participant: *Mhhh it is comparable when I compare it to the rest of the hospitals likeHospital C. I won't be very exact in terms of the turnaround times. The x-ray can take like 20 minutes and sometimes up to an hour.*

Researcher: *And that is acceptable.....those turnaround times?*

Participant: *I think it is acceptable although from time to time you have to go and speak to the radiographer. Just to give you an example, sometimes you want to have a bedside x-rays and there is only one person especially after hours and you find yourself struggling to get the x-ray.*

Researcher: *When you get an x-ray is it usually of good quality? Are you able to make a diagnosis from them?*

Participant: *Ja reasonable*

Researcher: *And radiologist report, do you get those?*

Participant: *Eh that is one of a big problem and that one is a big problem, we were struggling to get a radiologist and our CT scans were done outside the hospital and that is where we need a radiologist.*

Researcher: *And for general x-rays do you get a radiologists opinion on hard to read images?*

Participant: *We hardly request for that and I cannot even remember when last I required that.*

Researcher: *So you are able to interpret your own x-rays.*

Participant: *Yes*

Researcher: *In terms of emhhh the services that they offer, are you covered? For example if you are in theatre and you require their services, do you get that?*

Participant: *No in theatre we usually need them for C-arm and contrast and if we make arrangements in time we get that.*

Researcher: *Ok now the last question, can you give me three thing that they need to work on to improve their services?*

Participants: *First they need to employ more radiographers especially after hours, you need to have at least more than one radiographer. After hours and even weekends they need more radiographers, secondly, they need more radiologists, thirdly this system of putting images on films I don't think it is really helping much. I think they should consider a software system.*

Researcher: *oh...digital system? If I may ask more on that one what are the disadvantages of the current system?*

Participant: *X-rays can easily get lost, the patient from casualty may arrive there without x-rays. That x-ray is so important and you need to base decisions on it. Also, when it comes to filling, you find that if there was software it would be easy to retrieve all the x-rays because all the wards have computers.*

Researcher: *Thank you very much Dr.....and all the best for the rest of your day.*

Participant: *Good luck for your research.*

Researcher: *Thank you.*