

**KNOWLEDGE AND PRACTICE OF RADIOGRAPHERS
WHEN IMAGING CHILDREN WITH NON-ACCIDENTAL
INJURIES AT A PUBLIC HOSPITAL IN
KWAZULU-NATAL, SOUTH AFRICA**

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Dissertation submitted in fulfilment of the requirements for the Master of
Health Sciences in Radiography degree at the Durban University of
Technology

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Date: 12 December 2019

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is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources).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.

18/08/2020

Signature of student

Date

Approved for final submission

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PhD: Health Sciences; MBL; MTech: Therapy;

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Dedication

I dedicate this dissertation to my lovely wife, my two wonderful boys, my late parents and the rest of my family. I also dedicate this project to my supervisor Dr. P.B. Nkosi for her patience, guidance, and encouragement.

Acknowledgements

I thank God for life and protection he provides for me and my family.

I would like to express my gratitude to the following people who contributed to the success of this study.

- Dr. P.B. Nkosi, for her tirelessness and meticulous guidance, encouragement continuous support to ensure a completed project.
- The Durban University of Technology, for affording me the opportunity to study and complete Master of Health Sciences in Radiography degree.
- The KZN Department of Health; eThekweni Health District; and the study participants from the selected public hospital for granting me permission to conduct my study and affording me their time.
- My wife Ntshepiseng C. Lekaota for her love and having to put up with an absent husband.
- My children Neo and Kutlo for their surprising encouragement and their wish to see me prosper.
- My late mother Ontsheketse Lekaota for her support, and her wish for me to achieve better.
- My siblings Mosimanegape, Ntswaki, Thabo and Matlhogonolo with their endless motivations.

Abstract

Non-accidental injury (NAI) in children is defined as an abuse, where injury is inflicted intentionally. Radiographers are the first point of care to identify the area with injury and provide x-ray films to show that the injuries result from NAIs. The research shows a dearth of studies on knowledge and practice of radiographers when imaging children with NAIs. It is imperative to understand this information in order to provide training for radiographers, and ultimately improve the diagnosis of NAIs, so that children can be protected from the abuse.

Aim of the study

The purpose of the study was to explore radiographers' knowledge and practice when imaging children with NAI in order to develop them in this aspect and ultimately recommend training required.

Methodology

An exploratory, qualitative research design using a case study approach was employed in this research. Criterion sampling was used to select a public hospital that treats children with injuries in KwaZulu-Natal. Homogenous sampling was used to select radiographers employed by this hospital to participate in the study and a sample size of 10 radiographers participated in this study. Semi-structured, face-to-face and one-on-one interviews utilising open-ended questions were used to collect data from the participants. Data collection stopped with the 8th participant when data became saturated. Data was transcribed verbatim before data analysis. Tesch's method of data analysis was used in the analysis.

Findings

Collected raw data was transcribed and proceeded with thematic analysis where the following themes merged; knowledge of NAI in children, care of children with NAI, practice when imaging children with NAI, quality of images in children with NAI and acquiring knowledge of NAI in children. The study revealed that radiographers lack knowledge and practice on imaging children with NAI. The

study findings also identified factors that compromise a lack of knowledge and practice.

Conclusion

It is vital for radiographers to attain knowledge and practice on imaging children with NAI so as to enable them to detect a suspected NAI case. The intervention of Government on the implementation of relevant policies pertaining NAI, will assist radiographer and other medical team to follow all required procedures elicit the evidence of NAI. The participants of the study insist they require training on how to treat and classify NAI cases, and the ultimately goal is to secure the safety and protection of children.

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Glossary of terms

Child abuse

Child physical abuse, as defined by the World Health Organization, refers to the intentional use of physical force against a child that results or has a high likelihood of resulting in harm for the child's health, survival (death), development or dignity (Chaiyachati and Christian 2019: 1).

Child Maltreatment

Child maltreatment includes neglect, physical, sexual, and emotional abuse, and fabricated or induced illness (National Collaborating Centre for Women's and Children's Health 2009: 1).

Classic Metaphyseal Lesion

Is a meta-physeal abnormality or alteration which represent partial or complete planar micro-fractures that resemble a "bucket-handle" or a "corner fracture," near the growth plate of the femur (Ayoub *et al.* 2014:185).

Knowledge

Theoretical or practical information, facts and/or skills acquired through experience or education.

Misdiagnosis

Incorrect identification (diagnosis) of an illness or medical condition, including physical trauma injuries.

Multidisciplinary approach

According to Govender, Naidoo and Taylor (2019: 4), multidisciplinary approach is an integrated team approach to health, responsible for evaluation of treatment options and treatment planning for a patient in a collaborative process involving medical and allied health professionals.

Non-accidental injury

Brown and Henwood (1997: 201) define non-accidental injury as “physical or mental injury, sexual abuse or exploitation, negligent treatment or maltreatment of a child by a person who is responsible for the child's welfare”.

Radiographer

Radiographers are members of clinical medical team, and they are responsible for producing clear and accurately labelled images suitable for the medical diagnosis in process (Sudbery *et al.* 1997: 192).

Radiographic imaging

Is an imaging procedure using x-rays, gamma rays or similar ionising radiation to view internal organs to diagnose and manage patients.

Radiologist

A radiologist is a medical doctor that has specialised in diagnosing and treating injuries and diseases with the use of medical imaging procedures such as x-rays, bone density, magnetic resonance imaging (MRI), computed tomography (CT), mammography, fluoroscopy and angiographic intervention.

Trauma

A deep psychological or physical (injury) disturbing experienced by a person.

List of Acronyms

Acronyms	Acronyms
CEO	Chief Executive Officer
CPD	Continuing Professional Development
HPCSA	Health Professional Council of South Africa
KZN	KwaZulu-Natal
NAI	Non–Accidental Injury
VAC	Violence Against Children
WHO	World Health Organization

CHAPTER 1: ORIENTATION OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND OF THE STUDY

Definition of non-accidental injury by Nguyen and Hart (2018: 123) regards it as an injury to a child resulting from an abusive act by a caregiver. The author further explains such act is a primary cause of escalation of abuse and ultimately subject to death in children. The idea of intentional harm in children was abstracted by Caffey in 1946 (Jayakumar, Barry and Ramachandran 2010: 189). Non-accidental injury in children maybe explained or understood differently, depending on individual case. According to Aertsen (2017:1), children are abused in different ways such as emotionally, through neglect, sexually and physically. The author maintained that physical child abuse is synonymous with non-accidental injury, or inflicted injury.

Diagnostic radiographers are professionals trained to image internal organs with the use of different radiation equipment in order to acquire images. Every modality of radiographic imaging requires intensive training from the university, to include practical's undertaken in a radiology department. The intervention radiographers on NAI, requires them to have history of the injury, the child to be clinically examined, and radiological investigations which include radiographic and cross-sectional images (Nguyen and Hart 2018: 125). However, radiographic imaging of NAI remains the bone of contention because there is no general agreement regarding the type of imaging modalities are appropriate in the workup procedure of a child who is suspected of being abused. Paediatric radiography in NAIs faces a challenge in terms of a lack of formal training, in order for radiographers to be confident and knowledgeable with professional expectation on imaging children with suspected NAI.

The researcher of this project observed that radiographers perceive all trauma cases the same way in children, unless being alerted, yet the clinicians rely on them to aid in the diagnosis of NAI. It is imperative to equip radiographers with

knowledge and training in imaging children with NAI to improve the diagnosis. When imaging children with NAI for diagnostic purposes, radiographers ought to elicit the true story of the trauma and produce images of quality to provide evidence of NAI. Clinicians are also challenged to diagnose NAI and rule out other pathologies that presents with signs and symptoms that are similar to NAI, misdiagnosis could lead to psychological challenges, physical disability and death. (Jayakumar, Barry and Ramachandran 2010: 189). Nguyen and Hart (2018: 125) emphasise that clinicians rely on radiographers to produce radiographic images of quality that would aid in the diagnosis of NAI.

1.2 PROBLEM STATEMENT

Non-accidental injuries (NAIs) in children lead to death if unrecognised. When imaging children with NAI for diagnostic purposes, radiographers ought to elicit the true story of the trauma, and produce images of quality to provide evidence of NAI. Ebrahim (2008: 5) acknowledges the suspicion of NAI in children as an important step for child protection measure, and maybe done by people involved in diagnosing the child. According to the National Collaborating Centre for Women's and Children's Health (2009:16), there are obstacles among healthcare professionals that hinders correct diagnosis of children with NAI. Some of these obstacles relate to the healthcare professional's personal experiences or lack of training (Department of Health 2009:16).

Radiographers need to clarify the history and observed injuries when imaging children with suspected NAI, in order to provide diagnostic quality images with the adherence to standardised imaging protocols (Freeman 2005: 10). Offiah and Hall (2003: 702) acknowledge that; the engagement of radiology intervention on NAI suspected cases, has a significant role in more than 80% of abuse-related injuries in children are being diagnosed with radiographic imaging. However, there is insufficient available information with regard to radiographers' knowledge and practice when imaging children with NAI.

The study by Eben (2017: 35) reported a high child abuse rate that constitutes public health issues in most African countries, with limited available data on child

abuse, lack of guidelines on how to manage child abuse in hospitals and other healthcare facilities catering children. Kellogg (2007: 1233) further emphasises that thorough medical examination, diagnosis of suspicious NAI and reporting child abuse, may prevent further physical abuse in children. The same author maintained that there is 35% of child abuse re-occurrence without proper diagnosis and social intervention as a result of not following guidelines when imaging children with NAI. The truth of the matter is that, there is a significant interval pertaining child protection service delivery and the stigma can be turned around if the society can be educated on forms of violence and children's rights (Eben 2017: 35).

1.3 AIM OF THE STUDY

The purpose of this study was to explore radiographers' knowledge and practice in imaging children with NAI in order to develop them in this aspect and ultimately recommend training required.

1.4 RESEARCH QUESTIONS

The study sought to answer the following questions:

1.4.1 Main research question

What knowledge and practice do radiographers have on imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa?

1.4.2 Sub-questions

- a) What knowledge do radiographers have about imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa?
- b) What are the practices of radiographers when imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa?
- c) What training is needed for radiographers to improve on their knowledge and practice when imaging children with NAIs?

1.5 SIGNIFICANCE OF THE STUDY

When imaging children with NAI for diagnostic purposes, radiographers ought to elicit the true story of the trauma, and produce images of quality to provide evidence of NAI. The study will identify gaps in the knowledge, skills and abilities of radiographers to produce images of good quality to provide evidence of NAI in children. It will ultimately recommend approaches or methods that can enable radiographers to improve in their practice and enhance their knowledge when imaging children with NAIs. It will therefore benefit the radiographers at the selected hospital by:

- Enabling them to gain competency in recognizing signs and radiographic appearance of possible NAI.
- Improving their ability to provide the evidence of abuse in children.
- Improving their competency in differentiating between NAI, trauma and pathology.
- Improving their knowledge and practice when imaging children with NAIs. In so doing, their skill in radiographic technique and image evaluation, will be enhanced.
- Improving their knowledge in the reporting channels such as reporting suspicions clinical or radiographic signs of NAI observed during radiographic imaging.
- Being provided with training that will enable them to improve in their practice when imaging children with NAIs.

1.6 STRUCTURE OF THE DESSERTATION

This dissertation is presented in six chapters as outlined in Table 1.1.

Table 1.1: Structure of the dissertation

Chapter	Title	Content description
1	Orientation of the study	Introduces and gives the background of the study. It further outlines the purpose of the study, the aim of the study, problem statement and the significance of the study.
2	Literature Review	Illustrates the in-depth information in relation to the study. The significance of theoretical framework laid a foundation for study guidance and structuring contents of the study.
3	Research design and methodology	Presents a specific technique adopted in research on how to gather information to prove the researcher's theory. The research techniques involves, research paradigm, design, study setting, sampling process, pretesting data collection tool, data collection, data analysis and the trustworthiness of the study.
4	Presentation of the findings	Presents the findings and interpretations.
5	Discussion of findings	Relates the findings with of the study with literature and the aim of the current study.
6	Conclusion, limitations and recommendations of the study	Summarises the study and illustrates recommendations of the study, limitation of the study and conclusion.

1.7 SUMMARY OF THE CHAPTER

This chapter introduces the study and further outlines the background of the research study, the significance of the study, problem statement, aims of the study and research questions used in the study. The significance of the study explains the necessity in exploring radiographer's knowledge and practice on non-accidental injury in children. The chapter briefly outlines the structure of the dissertation with brief explanations. The next chapter presents the literature review, which assists with relevant information, theory and the relation to the study.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The current study intends to explore knowledge and practice of radiographers when imaging children with NAIs. Therefore the literature review will highlight the missing information for radiographers and other stakeholders in relation to NAI. It will further outline the new direction and benefits of the study.

2.2 DEFINING NON ACCIDENTAL INJURIES

The term NAI is universal as it may be conceivably accurate because it does not exclude accidental injuries to a child (Paddock *et al.* 2017: 179). Southall and MacDonald (2013: 199) define NAI as ill-treatment or abuse that includes physical, emotional, neglect, sexual molestation, or careless treatment, which ultimately lead to harming the child's health, integrity, growth, power or trust. The study by Kellogg (2007:1232) reports that violence in children is demonstrated by soft-tissue injuries (recognized due to visible contusion, bite marks and burns) and fractures. Other fractures maybe due to accidental falling, physical sport and fortuitous trauma to the child (Jayakumar, Barry and Ramachandran 2010: 189). Southall and MacDonald (2013: 199) state that in spite of how child mistreat maybe categorized, it is accompanied by various injuries with significant impact to immediate patient management, diagnosis and future plan on how to handle suspected child abuse cases.

Despite the fact that it is common to have accidental fractures more than fractures caused by ill-treatment of a child, the doctor needs to remain alert of feasibility inflicted injury (Flaherty *et al.* 2014: 478). According to Kellogg (2007:1232), unreported physical child abuse continues to be a challenge because individuals and society differ in considering abuse, scanty information, practice and knowledge due to insufficient training among professionals in the identification of abusive injuries, reluctant to report suspicious abuse, and professional prejudice. Paediatric NAI is clearly related act of violence that intentionally or unintentionally

cause harm to the child, with greater chance of negative results on normal growth continuation to significant injury and death (Jayakumar, Barry and Ramachandran 2010: 189). Although numerous children that have suffered physical abuse will mostly have a single fracture, been abused will have only a single fracture, the existence of several fractures, fractures that indicates healing phases or fracture age, and compound fractures of the skull that indicates physical abuse (Flaherty *et al.* 2014: 479).

According to Kemp *et al.* (2006: 723), a record of 55% fractures resulting from physical child abuse in younger children have been documented. The same author further elaborate that most of these children are below 36 months of age, with over 80% of those children being less than 18 months old. Furthermore, abusive fractures in children are often unclear, because children are not legible to give the act that lead to the injury, and the possible signs and symptoms of abuse could be challenging to clarify. The referring physician needs to have access to radiologic procedures in order to recognize fractures that are related to child abuse, and commonly they are found all over the body (Kemp *et al.* 2006: 724).

2.3 THE IMPACT OF NAI WHEN IT IS NOT DETECTED

According to Kellogg (2007: 1233), child physical abuse affects all children without discriminative measures that includes, ethnicities, genders, age, and socioeconomic groups which could bears long term morbidity, mental disability and ultimately death. Kellogg (2007: 1233) further outline that children who sustained trauma to the head or abdominal injuries due to abuse, have less chance of survival as the injuries maybe severely debilitated more than children with head or abdominal injuries as a result of accidental trauma. Also, a majority of victims have a greater chance of behavioural and functional problems, such as mental disorders, physical aggression behaviours, poor academic performance, decreased cognitive process, depression and anxiety, and a deficit of social and personal relationship (Kellogg 2007: 1232 – 1233).

The implications of misdiagnosis of physical child abuse are extremely huge as medical diagnosis may indicate permanent damage to a child, parent, or both parties; therefore, it is essential that health care professionals and social workers to confidently recognise children that are victims of physical abuse, as failure to do so may result in as much as a 60% possibility of repetition of abuse, with more than 10% at risk of extreme fatal injury (Saayman 2003: 60). The research of Riney *et al.* (2018: 1) reported child fatalities of almost 5% of children that are victims of physical abuse, 75% of all children who suffered minor injuries due to abuse or neglect were less than three years of age. It is the responsibility of health care professionals to ensure that children return to healthy families, and to save children who suffer from the abuse and prevent them from harm or death.

According to Riney *et al.* (2018: 1), the diagnosis of child abuse continues to be a bone of contention amongst other practices by making assumptions, believing that it is an admissible punishment, which ultimately leads to no recognition of possible abuse. Children that are finally diagnosed with non-accidental trauma (NAT), were found to have defender injury (Riney *et al.* 2018: 2). The same author further state that a review by researchers estimated that, more than 80% of deaths in children occur due to non-recognition of abuse were they sustained head injuries, which could have been prevented with premature detection. Marine *et al.* (2014: 868) emphasis that, failure to recognize and diagnose child abuse through skeletal survey can leads to prolongation of inflicted trauma to the child, where accurate diagnosis is of paramount importance.

2.4 INCIDENCE OF NON-ACCIDENTAL INJURIES IN CHILDREN

Physical child abuse is not discriminative to gender, race and age, and socioeconomic environment (Kellogg 2007: 1233). Finkelhor *et al.* (2009: 5) estimated nearly 50 percent of all reported physical violence against children, are likely to suffer physical injuries and they probably more at the risk of being victims of abuse. Furthermore, several authors indicated children that suffered abuse are more likely to have fractures and bruises all over the body, especially head and neck areas. Southall and MacDonald (2013: 203) state that, majority child abuse

cases are kept as a secret amongst families and communities, especially rural areas where traditional laws are mostly practiced. A formal protection structure is required across medical centres is required to help training medical staff with the recognition of physical abuse, reporting process, treatment, documentation of results and observations (Janssen *et al.* 2013: 217).

2.4.1 A global view on NAI

According to Hillis *et al.* (2016: 2), immoral behaviour towards children is dehumanising, violation of children's rights and social challenge, with negative impact on how children relate to the society across the world. A report by Sleet (2018:1) portrayed injury to children as a subject of communal health hazards, with death consequential outcome of almost 2000 children below the age of 14 every day around across the world. Sleet (2018:1) further indicates that World Health Organization WHO reported an estimated 644,855 of children that die due to inflicted injuries before they reach the age of 15. According to Eben (2017: 32), Nigeria is rated one of the country with the biggest economic growth with less interest in the recognition of child abuse, but they have recently revised their direction about child molestation. In middle to low income country, A large numerical data that amount between 10 million and 30 million of children have been observed to have experienced physical body harm that may result to disability, and eventually lead to over 90% of deaths due to physical injuries (Sleet 2018: 3).

Southall and MacDonald (2013: 200) highlights that lack of access to medical care due affordability has an unfavourable outcome pertaining to detection of physical injuries, despite the global urge to avail medical services for everyone at a reasonable amount. The same author further elaborated that countries with limited resources due to financial constrains have little or no chance of delivering medical care services to their communities, and the struggle continues in acquiring treatment for the injured children since affordability to private medical care is a challenge. According to Mok (2008: 978), the global statistics are not of a true reflection due lack of statistical documentation and structural reporting, influenced by constitutional laws of countries, cultural believes and lack of medical care to children. Reported cases will appears minimal and conceal the true extent of child

abuse. A global recognition of injuries to children maybe intentional, and situation can be prevented and controlled to protect children (Sleet 2018: 4).

2.4.2 An African view on NAI

In an African proverb, a corporal punishment is deemed a requirement to intentionally inflict pain as a corrective measure for unwanted behaviour, and it often incorporated with physical violence (Eben 2017: 32). Corporal punishment is adopted by African families and schools as a corrective measure. According to Sleet (2018: 3), a physical injury in children due to assault is deemed an intentional act of violation that is not recognised by many African countries. Furthermore; African elders have either limited or no knowledge of the laws that protects their children against abuse and the act of physical harm will persist without imposing legal punishment to the perpetrators.

Janssen *et al.* (2013: 217) believes that due to lack knowledge about the legal structure by parents, corporal punishment was adopted as the only way to reprimand children in Africa and it was further acknowledged as a tradition. It is very crucial to African countries such as Ghana, Malawi, Kenya, and South Africa, that requires a reliable statistics on child protection matters. These countries are known to have lack of accurate and trusted information regarding child molestation, homeless children, child sexual exploitation and injured children as a result of violence to children (Eben 2017: 32). Southall and MacDonald (2013: 200) reports that African countries have been classified as unfriendly towards children, as African governments give less or no efforts to allocate funds for child protection programmes. The performance of Malawi in child protection programme is regarded the best in Africa despite the country's low economic growth.

African countries need to assess their level of commitment in the child protection programmes, budget allocation and child protection laws to be effectively reinforced for the safety of the children. Southall and MacDonald (2013: 200) indicate that the country's level of success on children friendliness should be rated by the level child protection policy initiatives, strengthening of law enforcement against child molesters, improvement to avail health care facilities to accommodate

all children, especially those whom their parents cannot afford medical bills or stay far from the health medical care centres.

2.4.3 A South African view on NAI

A law was implemented in 1984, which mandated South Africans to report all form of abuse to the authorities but it was barely enforced (Janssen *et al.* 2013: 217). Due to lack of implementation, now South Africa is rated disproportionately high on the level of violence against children on the global ranking (Hsiao *et al.* 2018: 1). According to Hsiao *et al.* (2018: 1), South African children are observed to have a high level of violence with approximately 5.5% of child murders in 100 000 children globally, with South Africa doubling the statistics. According to Hsiao *et al.* (2018: 1), a current study provided with national delineation statistics on the prevalence of VAC, found that almost 20% of children suffer sexual molestation, in comparison to the universal average statistics for girls of 18%, and 8% for boys, and about 34.4% experienced physical abuse.

A confirmation by Albertyn and Nortjé (2014: 410) that, according to a recent report by United Nations International Children's Fund (UNICEF) indicated that the extension of violence against children in South Africa is unbearable; where thousands of children are abused sexually, physically and neglected, with most perpetrators evading the arm of the law. This eluding child abuse by perpetrators, only escalate the level of violence and less hope to the victims and their families. Albertyn and Nortjé (2014: 411) highlight that majority of child abuse victims will never get justice, since there is successful rate of only 7% of child molesters that are presented to the South African courts that leads to prosecution, while 93% of those cases leads to persuasion. The delay of forensic and medical reports are mostly implicated in the prosecution of child abuse and homicide cases, were evidence needs to validate the trauma sustained by the child against the evidence of violence against the perpetrator (Albertyn and Nortjé 2014: 411).

The level of reporting child abuse throughout South African society, it comprises with poor service delivery by the South African authorities, lack of child protection law enforcement, access to health care facilities and law enforcement agencies

especially for rural communities. These challenges Janssen *et al.* (2013: 217) indicates that the racialisation of reporting child abuse treatment may not be justified due to lack of access to hospitals and the police services, which are mostly located in town distant to majority of residents. Furthermore; the South African Police Child Protection Unit, social development and medical health care facilities reflect the statistics of their individual case reports, which it does not represent the actual number reported since they are not incorporated (Janssen *et al.* 2013: 217). Professionals and the general population do not believe that statistics of child abuse is at peak in South Africa. Though corporal punishment has been made illegal by the South African Constitution, many South Africans still believe strongly in physical discipline.

2.5 MEDICAL HISTORY FOR CHILDREN WITH NAI

NAIs in children must be suspected where an injury cannot be clearly explained, and the seriousness of the injury is in contradiction with the supplied history, or the inconsistency between the injury and the child's developmental growth Kennah (2011). Tiyyagura *et al.* (2017: 5) states that child abuse frequently occurs in young, nonverbal children who are unable to provide a history or in older children who may be too scared or feel loyal to their abuser and may not disclose the abuse. According to Kennah (2011), the extensive delay to acquire medical care by the caregiver after the child sustained an injury, child abuse needs to be suspected and investigated by the child protection services.

Weber (2015:1) encourages awareness about the caregiver's description of when and how an injury occurred. Paying attention to delays in seeking treatment, inconsistent stories (e.g. caregiver and the child's explanations differ or some historians may provide one explanation to a nurse and a different one to physician) may advocate that the cause of injury to the child not accidental. Tiyyagura *et al.* (2017: 5) urges the emergency clinician to note any suspicion by the caregiver's report of the history (e.g. a child presenting with a serious traumatic injury without any reported history of trauma, or a child who has a history of disobeying who presents with burns from a suspected submersion injury).

Flaherty (*et al.* 2014: 477) highlighted that the person taking care of the baby (caregiver) may intentionally provide wrongfully or incorrect history to hinder evidence of abuse and physician may not differentiate the diagnosis of childhood injury as a result, when fractures are initially evaluated, a diagnosis of child abuse may be omitted. Kellogg (2007: 1233) insists that proper recognition of children who are suspected victims of abuse can easily action appropriate examination, referral, investigation, for conducive outcomes for these children and their families. Furthermore, children normally suffer abuse that is imposed by the caregivers who wrongfully assess and responds inappropriately to the child's behaviour, like caregivers who had slapped, kicked infants in their care, parents are more likely to believe their children cry excessively.

According to Legano, McHugh and Palusci (2009: 31.e3); irrespective of presentation of the child in the emergency room, investigation of NAI needs to include history of the event that caused the injury from the parent or caregiver and the child, medical examination, laboratory test results and radiographic procedures. The same author further indicates that; the investigation process to exclude NAI necessitates adequate clinical history and radiological investigation reports. In cases of infants and younger children, occult injuries may not be identified during physical examination, but diagnostic radiographic imaging has the ability to provide the required information about skeletal injuries, spinal trauma and abdominal injuries that eliminate suspicion of abuse (Jain 2015: 336).

The primary responsibility of the radiologist on the NAI cases, is to detect radiologic findings that are indicative of physical abuse and, to differentiate abuse and pathologies that suggestive of abuse, provide with a possible fracture cause, fracture healing phases, and fracture age (Offiah *et al.* 2009: 461). In a case where physical abuse is suspected, it is vital for the clinician to check and rule out other injuries and maybe other underlying pathologies (Kellogg 2007: 1238). Furthermore, the extension of investigation will highly depend on extension of injuries, fracture mechanism, fracture age, physical examination findings, and the greater the injuries on younger children, the more the investigative scope requires testing to eliminate abuse. Fadheela *et al.* (2011: 2) emphasise the seriousness

and the importance of distinguishing between accidental and inflicted fractures as essential to protecting the child from escalation of abuse, as well as to respecting the privacy and rights of the parents without imposing accusation of child abuse since it maybe a shock to the family about the findings.

2.6 BEHAVIOUR AND EMOTIONS OF RADIOGRAPHERS DURING IMAGING

According to Barth (2009: 96), it is important to be highly sensitive around suspicious NAI cases, as 79% of these NAI cases are found to be caused by distressed parents and substance abuse by parents. It is imperative to treat all NAI suspicious cases with caution by not assuming that parents or caregivers are the abusers of the children, and professionalism needs to be portrait at all times during radiographic imaging procedures, with non-judgemental attitude being maintained. Often caregivers and parents express shame for failing to successfully protect the child against abuse, which may result in self condemnation due pain (Simon *et al.* 2017: 3). The primary duties of a radiographer are to perform radiographic imaging examination and care for both the child and the escort while they are in the radiology imaging department. The suspicion of abuse needs to be clarified with several tests, bearing in mind the possibility of pathologies that may present as a possible abuse.

Davies and Reeves (2009: 211-212) state that child protection is an emotional pathway, and it requires a rapid, careful, gentle treatment and sensitive discretion to acquire cooperation from both the child and the escort during radiographic imaging procedures. Radiographers are faced with tribulation to examine a child in suspicion of physical abuse, professionalism of the radiographer maybe challenged with a feeling of imposing protection the child and aggressiveness towards the parents or caregiver with suspicions of child abuse. It is unprofessional to convey accountability of child abuse to the escort, and it will escalate anger, discomfort, hostility and distress (Rigney and Davis 2004: 7 – 8). Radiographers look up to senior colleagues in the same profession regarding situations in which they lack experience, especially with paediatric radiographic examination to elicit NAI, with confidence of them having training and knowledge (Davies and Reeves 2009: 209). Radiographers are required to present professionalism, encourage

fellow colleagues, to build and sustain professional self-esteem amongst other health care workers such as radiologist, referring clinicians and nurses. (Davies and Reeves 2009: 209).

2.7 ROLE OF RADIOGRAPHERS IN CHILDREN WITH NAI

Wheeler and Hobbs (1988: 1233) state that bone fractures are always due to trauma, whether accidental or non-accidental, and that the issue is eliciting the true story of the trauma, while Hogg *et al.* (1999: 127-128) state that after the radiographers had passed all documented facts to the relevant professionals responsible for child protection, they should let the professional manage the case. The same author further indicates that the court of law may impose sanction to the radiographer, to provide evidence pertaining the child's physical presentation, behaviour of the escort and state the exact actions of both the child and the escort. Therefore; it is important to record details of the history that lead the parent or caregiver to acquire medical help for the child. Davies and Reeves (2009: 206) acknowledge radiographers as well-positioned to recognize possible signs of physical abuse, detection of new and old fracture on radiographic images, and the patterns of fracture mechanism that presents as possible physical infliction, which needs to be discussed with senior radiographers and radiologist while the child in suspicion of abuse is still around the radiography imaging department. Part of the role of radiographers is to ascertain whether there is a need for additional projection as needed to show particular anatomical structures, as achieved by routinely assessing radiographic images they have taken (Davies and Reeves 2009: 206).

The radiographer ought to pay attention to details and document the exact words of the conversation, records of the child's behaviour during the discussion, the radiographer needs to listen carefully and without presumptions of the event or interpreting the conversation (Freeman 2005: 11). Furthermore; the same author emphasises that, details of the event needs to be very clear and recorded in a professional manner that entails time of the incident, dates, signature of the witness (by another radiographer where possible) and signature of another professional.

The radiographer needs to report to the senior staff and also inform the identified member of the employing authority's child protection team (Freeman 2005: 11).

Radiographers with little or no child protection training may carry a high level of stress when they undertake the decision to exercise child protection procedures (Davies and Reeves 2009: 211). According to Hogg *et al.* (1999: 127-128), it is clear that radiographers requires an intensive training to be able to carry the responsibility and meet the demand of child protection. Hogg *et al.* (1999: 127 – 128) recommends the inclusion of child protection in the radiography qualification curriculum, job inductions, continuing professional development (CPD) programmes for regular updates and training schedules that entails generic skills pertaining child protection, detection and radiographic imaging technique and evaluation.

2.8 RADIOGRAPHERS' PRACTICE WHEN IMAGING CHILDREN WITH NAIs

Legano, McHugh, and Palusci (2009: 31.e3) explains that it is extremely significant to emphasise diagnostic radiographic imaging does not only detect injuries due to physical abuse only, but rather reflect the extent of the injuries and other medical diagnosis emerges that role out the abuse (Sudbery *et al.* 1997: 196). The routine and frequency of being in contact with children during radiographic and radiologic imaging, in most times, radiographer's position is vital when comparing the presented medical history, presenting radiographic images to provide evidence, hence it is important not to pose suspicion without facts and evidence (Freeman 2005: 10).

According to Jayakumar, Barry and Ramachandran (2010: 190), there are fractures with related factors that comprises with normal anatomical and physiological differences of skeletal appearance with new bone formation, birth related fracture, metopic sutures, iatrogenic injury and accidental injury and skeletal pathology such as rickets; osteopenia of prematurity chronic illness, Caffey's disease and osteogenesis imperfecta. The same author further indicates the existence of infective diseases such as syphilis, osteomyelitis and

osteogenesis imperfecta are frequently identified to cause bone fragility in younger children, including dentinogenesis imperfecta, osteopenia and ligamentous laxity. Nevertheless, it is important to acquire the skill to differentiate these disorders and NAI as they may coexist (Jayakumar, Barry and Ramachandran 2010: 190). Kellogg (2007: 1233) states that, "a thorough medical assessment will lead to a successful detection of NAI in children, comprising with reporting to the relevant child protection unit to prevent abusive acts in children. Furthermore, Kellogg (2007: 1237) indicates that, the recognition of NAI will give confidence in the detection and adequate diagnosis, that will help differentiate between bone disorders that causes bone fragility and physical inflicted injuries, in consideration with the provided history.

2.9 RADIOGRAPHIC APPEARANCE AND FINDINGS

According to Tiyyagura, Beucher, and Bechtel (2017: 125), injuries suggestive of abuse are: all injury in a pre-mobile infant that constitutes with bruises, injuries of the mouth, fractures, intracranial or intra-abdominal injuries; multiple organ injuries; multiple fractures; fractures to ribs, long bones; metaphyseal fractures; and other fractures (scapula, vertebra, sternum, hands, feet, and face). In addition, a subdural hematoma with or without a skull fracture and unexplained intracranial injury maybe observed. Jayakumar, Barry and Ramachandran (2010: 190) emphasise that the classification of fractures in relation to physical abuse has a unique appearance for abuse, and their mostly found on areas such as bilateral metaphyseal, complex skull fractures associated with an appearance of different fracture age.

According to Aertsen (2017: 1), fractures that associated with physical abuse are classic metaphyseal lesions, compound skull fractures, oblique and spiral fracture of the humerus, and posterior rib fractures in younger children or infants. The same author further indicates that; other fractures are uncommon due to their locations like fracture of the sternum, scapula, and spinous process, since these areas necessitate a significant force since normal handling cannot cause fractures. Fractures involving the ischio-pubic ramus have been linked with sexual molestation; often these are associated with multiple injuries Jayakumar, Barry and

Ramachandran (2010: 190) explains that due to excessive violence that in cooperate blows, kicks pulling, throwing, twisting, punching and shaking the child, injury mechanism will give fracture specificity of abuse irrespective if it was intentional or not.

Tiyyagura, Beucher and Bechtel (2017: 13) highlight that the presence of a coagulopathy does not always exclude abuse, as the cause of bruises or bleeding, nor does the presence of either accidental or abusive trauma exclude the likelihood of a coagulopathy. The same author further adds that there are clinical situations in which the evaluation of a bleeding diathesis may not be necessary, such as when the abusive event that led to the bruising is independently witnessed, or the child provides a clear history of the event. The main organs to be injured non-accidentally are: the stomach and duodenum, pancreas and liver; but the spleen and kidney are not often injured in comparison to accidental trauma (Carty 2001: 41-46). Jayakumar, Barry and Ramachandran (2010: 190) outline the relation of fracture types for NAI:

- high specificity metaphyseal fractures;
- fractured ribs maybe associated with pleural haematomas), scapular and outer-end clavicle;
- fractures ages (old or new);
- subluxation and vertebral fractures;
- multiple digital injuries on infants;
- compound skull fractures;
- bilateral limb fractures;
- Frequent fractures of mid-clavicular fractures and single long-bone fractures.

According to Carty (2001: 41); it is recommended that children suspected of NAI needs a CT head examination to eliminate brain injury or subdural haematoma, although they uncommon with head trauma in children, but it will assist to elicit a true diagnosis of NAI. According to Paddock, Sprigg and Offiah (2017: 181), a suspicious fracture that resembles physical abuse with an unsuitable history of the injury, thorough investigation is required to exclude NAI in children. Radiological

report is essential to explain fracture mechanism and particular specification pattern that classify the fracture and confirm the diagnosis and possible cause of the injury or how the injury occurred (Paddock, Sprigg and Offiah 2017: 181).

Kellogg (2007: 1237) explains that injuries due to physical abuse with fatal heart injury are not common and they result from chest compression with excessive force, causing multiple rib fractures which are more common and predictable physical abuse. Offiah *et al.* (2009: 461) further indicate that; because infants are still growing and their ribcage are likely to deform before the actually fracture, that justify the proportional scarcity of rib fractures in younger age group, were they are susceptible to fractures as a result of physical abuse. Offiah *et al.* (2009: 465) have highlighted that majority of difficult or assisted birth delivery of a large baby, a statistics capitulate no rib fracture noted in over 100,000 life babies including birth trauma and cardiopulmonary resuscitation cases.

Kellogg (2007: 1237) therefore breathing pattern notes that alterations in respiratory patterns may also signal central nervous system injury or reaction to pain, and uncommon injuries in connection with abusive blows or excessive pressure to the chest include hemopericardium and cardiac contusions occurring as a result of abusive blows to the chest; and shearing of the thoracic duct resulting in chylothorax. Kellogg (2007: 1237) states that, “careful assesment of the legs, arms, feet, hands, ribs, and head may conclude acute or healing (callus formation) fractures. Where fracture is suspected, surfaces should be cautious examined for “grab marks” that may suggest restraint or areas that were pulled or twisted to create the fracture; however, absence of such bruising does not eliminate abusive injury”.

Kellogg (2007: 1237) explains that a recent trauma consist of soft tissue swelling which may include bruises. Fractures of the ribs and metaphyseal fractures are not easy not easy to discover, so a negative clinical examination should not prevent the need for a radiographic skeletal survey when physical abuse is suspected, particularly in children younger than 24 months. Long-bone fractures needs to be evaluated carefully for non-accidental causes include metaphyseal fractures and

spiral or oblique fractures, particularly on infants, where both types of fractures have been associated with accidental mechanisms of injury (Kellogg 2007: 1237). Nguyen and Hart (2018: 126) indicated that, the presenting child for suspected abuse may not be the only victim of physical abuse in the family and siblings to be also examined for possible abuse. Nguyen and Hart (2018: 126) recommended that all radiographic imaging to be performed by not less than one radiographer who are well experienced with paediatric imaging, with the presence of the radiologist.

2.10 PROTOCOLS AND PROCEDURES

There are other imaging modalities that maybe used to detect NAI, but diagnostic radiographic imaging solely has the ability to detect inflicted injuries. With a follow-up imaging, chances of occult fractures detection increases especially following a NAI skeletal survey to acquire series of images (Offiah *et al.* 2009: 461). The functionality skeletal surveys on a NAI suspected case, is to identify fractures, clarify the cause of injury, classify mechanism of fractures and identification of fracture age (Nguyen and Hart 2018: 124). Aertsen (2017: 1) believes that for all physical injuries sustained by children below 24 months, skeletal survey should be employed as an investigating toll to eliminate child abuse, considering history and the type of injury suffered by the child.

2.10.1 Skeletal Survey

Jain (2015: 336) and Phillips *et al.* (2015: 55) acknowledges that a skeletal survey needs to be of a high quality standard with relevant radiographic images enable the radiologist to correctly recognize and interpret skeletal fractures. Several radiographic projections will be evaluated to identify if injuries resemble NAI. Children that presents in emergency room with a history of trauma and needs to be screened for possible abuse, were there is a positive confirmation or suspension, a series of radiographic images guided by skeletal survey is recommended for fracture evaluation Carty (2001: 40). Jain (2015: 336) and Freeman (2005: 15) indicate that the high quality images require special attention to be paid to radiographic positioning, proper centring, coning of images to relevant

body parts, and radiographic lead markers must be imaged. Additionally, the acquired date and time of the examination, name of radiographer and witness (usually second radiographer) needs to be documented on the image (Freeman 2005: 11).

On a physical child abuse case, fractures are the second common finding after skin observation presented with bruises and cigarette burns amongst others (Offiah *et al.* (2009: 461). In addition, the skeletal survey is the cornerstone radiological examination in suspected physical abuse. Sudbery *et al.* (1997: 195) states that the procedures that apply to the imaging of child abuse should specify who can request skeletal surveys and the conditions under which they should be carried out. Carty (2001: 40) states that the skeletal survey is the fundamental tool of the investigation for children suspected of physical abuse, radiology departments needs to implement and effectively use NAI protocols. The same author further indicates that; it is vital for the investigation of NAI to know the required radiographic image projections, time the images were obtained and radiographic technique.

Skeletal survey include a series of radiographic images viz.: antero-posterior (AP) of the humerus, forearms, femurs, tibia/fibulas, feet and posrero-anterior (PA) hands (Tiyyagura *et al.* 2017: 16). Additional radiographic images are the chest, rib views (AP, right and left obliques), thoracic and lumbar spine, lumbosacral spine (lateral), cervical spine, abdomen, skull (frontal and lateral) and pelvis (Tiyyagura *et al.* 2017: 16). Aertsen (2017: 1) recommends further examination and observation by having a follow-up radiographic imaging within 2 weeks from the initial imaging, which it may have revealed periosteal reaction that was not visible on the original radiographic images. The same author further indicated that classic metaphyseal lesions cure with or without new bone formation, which may also depend on the presence of periosteal stripping. Tiyyagura *et al.* (2017: 15) also believed that imaging a suspected child abuse victim for possible detection of occult fracture which may not be visualized at the beginning, which may confirm physical child abuse, and reveal possible fracture age.

Phillips *et al.* (2015: 55) further emphasised that it is important for appropriate evidence-based protocols to be developed and consistently implemented. In addition to the protocol, adequate education to health care workers, effective clinical and radiological intervention, NAI in children will gain the recognition and creating a better chance for child protection (Nguyen and Hart 2018: 123). For the society to overcome child abuse, training in the aspect of NAI needs to be extended to other professions especially those who work and have close contact with children like teachers, preschool teachers, social workers and law enforcement officers. Extending training to other professions will be extremely be vital for maximising chances of detecting NAI in children, while the law enforcement will be able to gather relevant information to be used as evidence which may lead to more successful prosecution of child abuse (Rigney and Davis (2004: 11). No study was done to understand what knowledge the diagnostic radiographers have in following the practice guidelines when imaging those children so that they can be provided with appropriate training.

2.10.2 Radiographic technique

According to Jain (2015: 336) and Freeman (2005: 15) the importance of performing skeletal survey and acquiring radiographic images of high standard, to ensure diagnostic quality of bony and soft tissue detail to detect fractures and elicit NAI. Nguyen and Hart (2018: 124) emphasis the a good radiographic technique will consider accurate centering point, inclusion of pertinent body parts, correct radiographic lead marker and adequate radiographic exposure factors for adequate penetration. In addition; patient's details, time and date of the examination to be clearly visible on the radiograph, radiographer's name and the witness (maybe the radiographer or an escort nurse) (Freeman 2005: 10). The radiographer to ensure availability (where possible) of the radiologist to formally assess radiographic images for good diagnostic quality, appropriate projections and for possible additional radiographic view. The radiologist may also assess the patient's condition and may refer for other medical examination to accumulate enough evidence to validate the diagnosis (Jain 2015: 337).

Normal good practice of radiographic imaging and correct anatomical markers (e.g. right or left markers) should be placed on the image field prior to exposure as required. Additionally, the indication projection such as prone or supine indicators, and the correct patient name and the date of the examination are to be indicated and legible on the radiographic image (Sudbery *et al.* 1997: 197). Further to this, Sudbery *et al.* (1997: 197) recommend that two radiographers be present in the examination room, and that both sign the request form and confirmation of the imaging process.

2.11 IMMOBILISATION FOR IMAGING NAI IN CHILDREN

Methods of immobilisation and restraint extend the opportunity for acquiring quality diagnostic images first time, however, the radiographer may not be aware of the level of force required to immobilise the child, particularly a distressed child (Sudbery *et al.* 1997: 195). This kind of information is vital for the better advantage to acquire diagnostic images of high quality, and not to extent the injury further (Jain: 2015: 336). The same author indicates that, when health care workers are trained on how to handle and retrain an injured child suspected of abuse, it will also add towards achieving images of extremely best quality (Jain: 2015: 336). Hancock *et al.* (1997: 286) urge that, because imaging procedures for abused children require immobilisation, sedation or restraint, therefore; it is imperative for radiographers to be accustomed with policy and procedures concerning the restriction of immobilisation and restraint. Radiographers also need to be aware of laws in relation to children's consent to medical procedure or examination.

Sudbery *et al.* (1997: 195) emphasised that radiographers must learn policy and procedures on how to restrain and immobilise children, this is to make sure that radiographers are able to make relevant judgement for adequate restraint. The process and decision of restrain maybe difficult since the child maybe distress and not being comfortable with strangers. It becomes a concern when a child object to the radiographic examination, more especially in a suspected abuse case, especially when the child's emotions may feasibly escalate the psychological trauma due to possible repetition of an abusive episodes (Sudbery *et al.* 1997: 195). Ebrahim (2008: 5) advises that a radiographer should request assistance

from another radiographer to help validate patient's personal details, documenting details of events witnessed and heard, and help witness the radiographic examinations and finally sign the documented record.

2.12 MEDICAL REPORTING

Tiyyagura *et al.* (2017: 5) stated that, the physical examination alone will rarely determine whether an injury was from an accidental or abusive mechanism. However, combining the history with a thorough physical examination will help determine whether abuse is to be classified as part of the distinctive diagnosis. Christian (2015: 1342) acknowledged that fracture patterns are highly unlikely to reflect characteristics of intentional infliction or accident, without considering the provided history of the injury, physical examination laboratory test results and radiographic report. Sherl (2013: 626) recommend a cautious physical examination to be performed, which involves a full observation of the skin for possible soft-tissue injuries, like bruises and burns, neurovascular and neurologic, abdominal examination, thorough assessment of the extremities. In the presence of swelling, minimal motion and deformity, there is a possibility of fracture. According to Tiyyagura *et al.* (2017: 5) even if a diagnosis of child abuse maybe confirmed during a medical examination by evaluating fractures and soft-tissue injuries, similar findings such as bruises maybe observed on a physical examination with other children who sustained an accidental injury.

According to Paddock *et al.* (2017: 181) health care workers should be encouraged to take note of details when dealing with NAI because there is a possibility of repeat of abuse, with a prospective of fatality if the diagnosis is missed. There is a possibility that the reporting radiologist may perceive possible details that indicate physical abuse, while it is an underlying disease with similar appearance to inflicted injuries (Paddock *et al.* 2017: 181). Follow-up NAI skeletal survey with series of radiographic images is not required were physical abuse has been eliminated as a possible cause of injury Nguyen and Hart (2018: 125).

It is expected that the radiologist does not rule out the possibility of inflicted injuries, where identified fractures does not fit the history of the child being injured. Once

the possibility of abuse is eliminated, the extension of investigation will be taken for an accurate diagnosis (Paddock *et al.* 2017: 181). The radiologist needs to confidently identify the fracture first, then assess and classify the type of fracture associated with the potential cause, and the verification of identifying the possibility of intentional physical injury to the child (Paddock *et al.* 2017: 181). Paddock *et al.* (2017: 181) further explained that characteristics of inflicted fracture demonstrate different patterns for different stages, during a healing process of the bone. Moreover; fractures that are sustained during an abusive act are more possible to multiply.

2.13 RADIOGRAPHER'S KNOWLEDGE OF NAI IN CHILDREN AND TRAINING

According to Sudbery *et al.* (1997: 196), awareness may be extremely vital where the suspicion of physical abuse is not suspected, for example, the referrals from casualty departments out of hours. Knowledge of radiological signs that may mimic abuse, such as those caused by rickets or brittle bone syndrome is also an advantage, although it is not essential, as images will ultimately be reported. However, training radiographers on NAI detection and imaging will extend confidence of radiographers when dealing with children suspected of NAI, and it will maximise the level of detection of physical child abuse (Rigney and Davis 2004: 11).

Though Murphy and Neep (2018: 83) acknowledge the lack of planning for training radiographers pertaining NAI in children where the process is still on the foundation phase, due to lack of educational resources. There are training programmes for radiographers such as image interpretation that have been reported with a positive remark of growing, and there is a greater hope for NAI programme that will help save lives of the children. No study was done to understand what knowledge the diagnostic radiographers have in imaging those children so that they can be provided with appropriate training. Sudbery *et al.* (1997: 196), as well as Tonmyr and Hovdestad (2013: 412) emphasise that under-reporting may still be an issue, which may be due to lack of training of health professionals.

Fractures that are sustained as a result of NAI is considered to be very low when compared to all childhood fractures, besides, they are of a greater challenge to clinicians to diagnose and may result to significant physical injuries, psychological trauma and death due to fatality (Jayakumar, Barry and Ramachandran. 2010: 189). Paediatric NAI comprises a neglected child at a compromising position of being injures and physical harm, which is regarded as intentional where sustain minor injuries that progress to deaths. Sleet (2018: 1) the diagnosis of NAI was not recently discovered by the medical scientist, but the progress in the recognition of detection and prevention for recurring and ultimately saving the life of the young children.

Radiographers require training on the social exposure of abuse, so as to recognise that exposure to NAI is not restrictive to race, social class or gender (Rigney and Davis 2004: 12). Freeman (2005: 18) further emphasised that training on child protection for radiographers needed to be part of the induction programme and be continuous for all radiographers. Southall and MacDonald (2013: 203) believed that the process of detecting NAI in children requires commitment and highly trained and motivated multidisciplinary team that includes, nurses and doctors, radiographers, police and social workers, with properly documenting of medical examinations and records. Part of a radiographers' role is participating in the radiographic imaging choice in the child abuse case, since they consider issues as consent, restraining the child and immobilisation as required to attain good diagnostic and relevant images that confirms abuse (Sudbery *et al.* 1997: 192). This requires knowledge of procedures, guidelines, and adequate information of the social and legal environment for radiographers to engage productively in the overall process (Sudbery *et al.* 1997: 193).

2.14 CHILD PROTECTION

According to Davies and Reeves (2009: 205), radiographers have traditionally imaged children with injuries as their primary duty, but their role of responsibility pertaining child protection has never been fully explored. According to the nature of radiography duties, they are in contact with different patients from collection of sources that includes; trauma and emergencies, general practice, and referring

clinics. This makes radiographers unique, because they are well positioned for detection, imaging and recording of relevant documents. Work related to child protection matters established an important proportion of NAI in children and imaging, but less involvement in training and promoting child protection for radiographers is of a distance matter (Sudbery *et al.* 1997: 193). Radiographers are members of medical teams and have physical contacts with children and adult (normally parent) during radiographic examination or other radiological imaging, and are authorized for producing clear and accurately classified images relevant for the clinical task in process (Sudbery *et al.* 1997: 192). Furthermore, Thomas (2005: 160) confirms that radiographers play a vital role by providing with radiographic images of diagnostic quality. Ultimately, they should be competent to recognise signs and radiographic appearance of possible NAI.

The first vital step is the acknowledgement and suspicion of non-accidental injury (NAI) in children for the initiation of detection and child protection process. Several health care workers are eager to take part but they fear the responsibility due to lack of information (Ebrahim 2008: 5). The same author emphasises that radiographers and radiologists bare the same responsibility as health care workers with a possibility first care point during radiographic examination process to eliminate NAI by creating a chain of evidence. Davies and Reeves (2009: 206) report that just over 40% professionals may report a suspicious child abuse, since they have to follow long processes that maybe fruitless due to lack of training and law enforcement laws. When the radiographer is well informed about NAI, child protection becomes more easy and beneficial to the needy (Davies and Reeves 2009: 211).

2.15 MISDIAGNOSIS OF NAI IN CHILDREN

Radiographic imaging remains a controversial issue with little of consistency in regards to how, when and which modality of choice is more productive in the workup of the child, suspected of being abused (Nguyen and Hart 2018: 123). The same author maintained that inability to detect NAI poses high risk for morbidity especially to nonverbal children. It is also the case that conventional radiography is the cornerstone in the assessment of suspected NAI. Its role in NAI is to find

evidence of abuse and normal trauma by identifying fractures and age at which the fractures occurred (Offiah *et al.* 2008: 461; Phillips *et al.* 2015: 55).

Radiographers find themselves in a predicament where they are expected to successfully detect NAI, carry out a skeletal survey that consists of series of images without protocols on NAI, radiographic technique without adequate training and psychological challenge to examine a distressful child to abuse Jayakumar, Barry and Ramachandran (2010: 189). The ultimate responsibility for NAI diagnosis rests with physicians, with radiographers routinely assessing images they have taken in order to highlight areas that need particular clinical attention (Kemp *et al.* 2006: 724).

2.16 SUMMARY OF THE CHAPTER

The chapter presented details challenges of diagnosing of NAI in children, the impact of misdiagnosing NAI, radiographic protocols and post psychological challenges faced by the children and radiographer. Radiographers lack knowledge on radiographic technique, pattern recognition on NAI and they do not know what is expected from them when imaging a NAI case in children. The knowledge found in the literature gave background on protocols and procedure, but radiographers lack the radiographic practice to implement the relevant protocol. Very few research studies have been found in relation to knowledge and practice of radiographers when imaging children with non-accidental injuries, which indicates a gap that requires to be filled in the current research study. The next chapter outlines the research methodology that guided the study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The purpose of this chapter is to describe the research methodology that underpins the investigation into the problem. In so doing, it explains the methods that were used to conduct the study, the area where the study was conducted, the sampling process, and the inclusion and exclusion criteria for the sample, the data collection process and its analysis in the study. It also discussed the ethical considerations as well as the validity and reliability of the research tool. Before discussing the research methodology that was used in the study, the researcher will briefly discuss the ways in which researchers select how they conduct their investigation into a problem.

3.2 RESEARCH PARADIGM

The research paradigm is a set of philosophies or assumptions that provide direction to the inquiry (Creswell 1998:74). The interpretivist was selected as an approach for this study. It was used to understand the subjective world of human experience, pertaining to imaging on NAI in children. The central endeavour of the interpretivist paradigm is to understand the subjective world of human experience (Kivunja and Kuyini (2017: 33). This approach aims to understand and interpret the viewpoint of the subject being studied rather than the viewpoint of the researcher (Kivunja and Kuyini (2017: 33).

Kivunja and Kuyini (2017: 26-27) outline essential elements of a research paradigm as follows:

- Ontology is the philosophical study of the nature of existence or reality. The reality in the study is that, radiographers image all trauma cases the same, including suspected NAI case in children.
- Epistemology is concerned with the very bases of knowledge, its nature, and forms and how it can be acquired, and how it can be communicated to

other human beings. The researcher will extract the existing knowledge on imaging NAI in children through interviews.

- Axiology involves defining, evaluating and understanding concepts of right and wrong behaviour relating to the research. The study will follow all ethical considerations required to do the study.
- Methodology is the broad term used to refer to the research design, methods, approaches and procedures used in an investigation. The researcher will formulate questions to collect data, analyse and write a report with recommendations.

3.3 RESEARCH DESIGN

According to (Kothari 2004: 31), a research design arranges conditions for collecting and analysing data such that it becomes relevant to the research's purpose in a study. The study used a qualitative method of approach. The rationale for using qualitative design is to allow participants to freely express themselves when describing their knowledge and practice when imaging children with NAI. Of the five approaches to qualitative study design, the case study approach is appropriate because it will facilitate the exploration of radiographers' knowledge and practices in imaging children with NAI (Baxter and Jack 2008: 544). A definition of qualitative case study methodology by Baxter and Jack (2008: 544) states that, it provides tools for researchers to study complex phenomena within their contexts and that when it is applied correctly, it evaluates programs, develop interventions and aids in the exploration of a phenomenon. Qualitative research position the significance upon the understanding and the exploration of individuals or group attributes of behaviour, experiences, people's believe, social or human problem, to acquire a perspective that defines contribution to the issues (Almalki 2016: 291). The selected research method of approach is relevant for the exploration of radiographer's extensive knowledge about NAI in children, and their daily practice when imaging children that are suspected of NAI.

3.4 NATURAL SETTINGS

In qualitative research, research conductors study things in their natural setting in order to make sense of or interpret people's meaning to the phenomena (Creswell 1998:15). In so doing, researchers go out to the people or field of study, acquire access, and collect information (Creswell 1998:17). The current study was carried out in KZN, which is one of the coastal provinces of South Africa, with an estimated population of about 11 million people (South Africa, Department of Health KZN 2017: 35). The province has 72 provincial hospitals and 615 radiographers employed in the public sector (Health Systems Trust 2017: 306). The KZN province comprises 11 districts, and it is depicted in Figure 3.1 (Statistics South Africa 2014: 27). The study was conducted within the eThekweni District, home to the majority (33.5%) of the province's population, making it the most densely populated (Statistics South Africa 2014: 27). A map of the KZN province and its districts is shown in Figure 3.1 below.



Figure 3.1 Map of KZN showing the districts (Geohealth n.d.).

Public healthcare facilities in South Africa are structured according to a hierarchical referral system, and are classified according to the different categories corresponding to the services they are capable of rendering to patients (South Africa, Department of Health 2012: 35-37). Clinics, community centres, as well as district hospitals offer the most basic services, and are classified as Level 1. Regional hospitals are Level 2, provincial tertiary hospitals are Level 3, and the most comprehensive services are offered at Level 4, which has central hospitals and specialised hospitals (South Africa, Department of Health KZN 2017: para. 1 line 1). Imaging facilities may be found in hospitals at all these levels. Alternatively, hospitals may be differentiated by their different classifications, as explained by

the South African Department of Health (2012: 3) in the National Health Act of 2003. Using this system, hospitals may be classified as district, regional, tertiary, central, and specialised. This study was conducted at eThekweni District in KZN. Data was collected from a selected hospital that admits and treats trauma cases in children. This hospital is selected because it caters a large number of outpatient, inpatients and referrals from surrounding clinics, district hospitals, and other hospitals outside eThekweni District.

3.5 STUDY POPULATION

Study population refers to all members who meet the particular criterion specified for a research investigation (Alvi 2016:10). The study was conducted at a selected public hospital that provides healthcare services such as admission, treatment and paediatric radiology services to children with trauma at eThekweni District. There are 571 beds, with 2 200 staff, at the selected district and regional hospital (Department of Health Province of KwaZulu-Natal 2019: 1). The hospital employed a total of 23 diagnostic radiographers to provide a 24-hour radiology services. Some of those radiographers were doing their community service, while others had more than one year clinical experience in their profession. Their qualifications were either a national diploma, or a degree in diagnostic radiography. Radiographers on community service work under the supervision of qualified radiographers. The study population targeted all diagnostic radiographers registered with Health Profession Council of South Africa, and currently employed permanently at the selected public hospital.

3.6 SAMPLING PROCESS

Selection of participants is critical in qualitative design, and the researcher should document the rationale for the selection of such a study population, and disclose any preferences. Sampling is the process of selecting a particular segment of the population to represent the entire population of the research study (Polit and Beck 2013: 275). Sampling in a qualitative study is achieved by means of a non-probability sampling technique (Wilmot 2005: 3). In using non-probability sampling

in this study, the purposive sampling approach was used, and not all units in the population were selected to represent the study.

Qualitative research seldom agrees on the exact sample size required for a qualitative study, but agrees that certain factors influence the number of interviews required to attain saturation. A research study should estimate and qualify the sample size; hence, estimating a satisfactory sample size is associated with the theory of saturation (Marshall *et al.* 2013: 12). Terre Blanche *et al.* (2006:139) defines sampling as a process of choosing research participants from the whole population, which requires to make a conclusion about which people, events, setting, social and/or behaviour actions to observe. According to Alvi (2016:11) in the inquiry it is not feasible to evaluate every single component of a population, to be able to select a required group (smaller in number than the population) for the assessment.

Sample sizes are relatively small in qualitative research (Patton and Cochran 2002: 9). Consequently, this type of study, with a sample of around one to ten participants is interviewed until data saturation is reached. When the researcher can no longer extract new data as additional information as from previous interviews, then data saturation has been reached. (Malterud, Siersma and Guassora 2016: 1758). There are several factors that data saturation may depend on such as, the research audience, the researcher, scope and the availability of resources (Bonde 2013: 5). Irrespective of the sample size, qualitative research typically targeted at sampling generally to make sure that all important aspects and variations of the phenomena under study are present within the sample (Elliot and Timulak 2005: 151).

In the current study, the researcher used a non-probability purposive sampling methods and pursued a criterion sampling, where not every hospital and radiographer will be part of the study (Alvi 2016:30). Terre Blanche *et al.* (2006:139) define these methods as samplings that depend not only on availability and willingness to participate, but are typical of the population selected. Criterion sampling on the other hand is a non-probability sampling and the organisers of

the inquiry purposively choose the particular units of the universe for continuing a sample on the basis that the small mass that they selected out of a large-scale one will be typical of representative of the whole (Kothari 2004: 59). Using this sampling method, the researcher selected the hospital, which offers trauma services such as paediatric imaging, admission and management of children with trauma. The selection process also involved the selection of radiographers employed by the selected hospital. Homogenous purposive sampling was used to select 10 participants that were interviewed, and data saturation was reached with the 10th participant. Zikmund and Babin (2010: 423) define homogenous sampling as a technique in which units of the sample are selected on the basis of personal judgement or convenience. The sampling chosen for the study is well suited for exploratory research intended to generate new ideas that will be systematically tested later (Alvi 2016:14). The quality of data obtained from this sample was high and rich, because the researcher worked with willing participants and interviewed them at their own leisure time.

It was necessary to ensure that the study participants met certain pre-determined criteria for them to be included in the study. These criteria are explained in the following section:

3.6.1 Inclusion criteria for diagnostic radiographers

Radiographers were included in the study if they:

- Were registered with Health Professional Council of South Africa (HPCSA).
- Were registered as diagnostic radiographers
- Had at least 1 year clinical experience.

3.6.2 Exclusion criteria for diagnostic radiographers

Radiographers were excluded in the study if they:

- Were community service diagnostic radiographer due to lack of clinical experience.
- Were registered as radiographers in the other categories other than diagnostic.

3.7 DATA COLLECTION INSTRUMENT AND TECHNIQUE

A semi-structured, one-on-one and face-to-face interview was used to collect data from the participants at the selected hospital. The interviews consisted of structured open-ended question (Appendix 9) to allow the participants to talk freely. The participants were interviewed individually depending on their availability and workflow of the department.

3.8 DATA COLLECTION PROCESS

Data collection entails obtaining the subjects and gathering data for the study (Burns and Grove 2010: 361). The data must be collected in a consistent way, which is crucial for study validity to be maintained (Burns and Grove 2010: 361). Researchers need to develop clear and detailed data collection guidelines to ensure that the results obtained will be accurate, reliable, and unbiased (Johnson 2014: 97). Before data collection, the researcher obtained ethical approval from Institutional Research Ethics Committee (IREC), with an allocated Ethical Clearance number IREC 008/19 (Appendix 1). The gatekeeper permission was requested from KZN Department of Health (Appendix 2a), the eThekweni Health District Manager (Appendix 3a), the Chief Executive Officer (CEO) (Appendix 4a) and the Head of Radiography Department (Appendix 5a).

The radiographers that suited the criteria were approached once permission was granted by KZN Department of Health (Appendix 2b), the eThekweni Health District Manager (Appendix 3b), the Chief Executive Officer (CEO) (Appendix 4b) and the Head of Radiography Department (Appendix 5b). To recruit the participants, the researcher requested the Head of Radiography Department for a brief meeting with radiographers in order to explain the study and ask those interested to participate. After the meeting, the researcher left them with research conductor's contact details so that those willing to participate could contact the researcher on WhatsApp to schedule the time and venue for the interview.

Before commencing with interviews, the researcher informed participants that their participation is voluntary, and that they may withdraw from the study at any

time if they so wished without bearing penalty, they would remain anonymous, information collected from them would be confidential, and that they will not be remunerated for participating in the study. They were given a letter of information (Appendix 6) and requested to sign consent (Appendix 7) before participating in the study. To achieve anonymity and confidentiality, no names or identifying information would be collected or published in the final study and where necessary, pseudonyms will be used. The researcher collected the demographic information of participants (Appendix 8) before the interviews. Bengtson *et al.* (2004: 75) explains that demographic data is useful for providing a contextual background about the participants in qualitative studies. In-depth, semi-structured, face-to-face and one-on-one interviews using interview guide with open-ended questions (Appendix 9) was used to collect data. Creswell (2013: 241) states that open-ended questions are asked to interviewees in order to gather data that will lead to a textural and structural description of their knowledge and practice when imaging children with NAIs. The open-ended questions allow the participants to talk freely.

The interviews were conducted at work at the radiographers' leisure time and were conducted in an office where there was no noise. They involved posing questions to respondents, and the order in which these were asked was not rigid, but rather participant-led (Flick 2017: 233). In addition, follow-up questions known as probes were asked, based on what respondents had said during the interview (Flick 2017: 233). One-on-one interviews were preferred because they are easily managed, allowing rapport to be built, and they provide an optimum environment for participants to think, speak, and be heard (Smith, Flowers and Larkin 2009: 57). Such an arrangement is well suited to, and encourages in-depth and personal discussion (Smith, Flowers and Larkin 2009: 57). Interviews were audio recorded with the permission of participants, and a verbatim written transcription of each interview was produced. The transcript was then used for the analysis.

All interviews with participants were conducted in English, because the interviews involved radiographers who had completed their higher education in English, so it was assumed that they were fully conversant in the language. The interviews were

approximately 30-45 minutes long with each participant and took place where participants preferred and felt comfortable. To avoid disrupting the workflow, interviews were conducted at a time that was convenient for participants and in a room where it was quiet in the radiography department of the selected public hospital. To ensure that participants honour their participation in the study, interviews were conducted at the hospital, in radiography department to easy access for their availability and in a quiet room where there was no disturbance. The participants preferred to be interviewed during their lunch time.

Data was collected from participants until data saturation. Data saturation was reached with the 8th participant and the researcher interviewed two radiographers to verify data saturation. Data saturation is achieved when there is no new information and redundancy is obtained from additional participants (Polit and Beck 2006: 321; Malterud, Siersma and Guassora 2016: 1758). Bonde (2013: 5) adds that data saturation may depend on a variety of factors such as the researcher, research audience, scope, and availability of resources. In broad terms, saturation is used in qualitative research as a criterion for discontinuing data collection and/or analysis. Regardless of the sample size, qualitative research typically aims at sampling broadly to ensure that all important aspects and variations of the phenomena under study are captured within the sample (Elliot and Timulak 2005: 151). In this study, the final sample size was 10 participants.

The interviews were set to begin on the instruction and timing of the participants. The researcher audio-recorded the interviews with their permission. All participants agreed to be audio-recorded. To maintain confidentiality, all personal information obtained from this study was kept strictly confidential and presented as anonymous. Confidentiality was attained by not indicating the work place, gender, age and occupation of the participants (Kaiser 2009: 1). Collected data was stored on the computer with a password access known by the researcher only, to ensure safe keeping and restriction of access. Lin (2009: 133) supports the safe keeping of data on a notebook and a secured backup file, with access restriction. All data will be deleted or discarded after five years after formal

processing, in case verification is required. Anonymity was maintained, as participants' real names were not used in the study and they were identified as participants.

3.9 DATA ANALYSIS

Analysis refers to the calculation of particular measures along with exploring patterns of connection that exist among data-groups (Kothari 2004: 122). Collected data was analysed using Tesch's thematic method of analysis by Creswell (2009:186):

1. The researcher got a sense of collected data by reading all transcriptions carefully.
2. The most interesting interview was selected and scrutinise, marginal thoughts that emerged were written down.
3. Lists of all topics that are similar were grouped together, and preliminary organised the topics into columns and arranged as themes.
4. Abbreviated the topic as codes and correspond next to the appropriate segments of the text, emerging topic or codes were written alongside the suitable segments.
5. The greatest descriptive phrases for the topic were use and turned into categories, reducing the total list by grouping topics as subthemes.
6. List of categories that emerged and associated topics were grouped together.
7. Data material belonging to each category was grouped in one place and performed a preliminary analysis.
8. The existing data was re-coded.

3.10 TRUSTWORTHINESS

It is appropriate to express the application of qualitative researchers and the reflection of the study findings; established by credibility, transferability, confirmability and dependability to address issue of trustworthiness (Shenton 2004: 63).

3.10.1 Credibility

According to Merriam, the qualitative investigator's identical concept, i.e. credibility, deals with the question, "How congruent are the findings with reality?" Shenton (2004: 64) displays the differences that trustworthiness is established by ensuring credibility. Credibility was attained when the researcher ensured the interpretation of participants' response were from an original view. The researcher consistently used the same research question for all participants during data collection process. In the study, data was collected by conducting an interview which was audio recorded then transcribed. The interview was done face to face until saturation was reached, where no new evidence contributing to the inquiry (Malterud, Siersma and Guassora 2016: 1758). Audio recording was played many time to ensure that, the transcribed information is correct.

3.10.2 Transferability

This refers to the capability to apply the findings in other factors or to other participants. The qualitative researcher is not essentially interested in the imprecision (statistically) of the research findings, but rather in explain the observations within the specific conditions in which they occur. Strategies to intensify transferability are widely descriptions, purposive sampling and data saturation (Brink, Van der Walt and Rensburg 2012: 173). Participants were selected following research process that also guided the relevant and potential participants for the study. The selection of participants was based on how they relate to the problem statement, academic qualification and work experience. According to Anney (2014: 277 – 278), the researcher account in managing transferability judgement with prospective user through a thick description and

purposeful sampling, by means of a detailed explanation of the enquiry, and participants were selected purposively. All participants fall under the same category of employment according to employment requirements, they all acquired minimum qualification for employment, and all participants are exposed to imaging children.

3.10.3 Dependability

Lincoln and Guba (1985) realised the need for establishment of trustworthiness of the study, and it may require inspection. The investigating auditor (generally a peer) will generally follow the process and a procedure employed by the researcher in the study and decide whether they are acceptable (Brink, Van der Walt and Rensburg 2012: 127). According to Kothari (2004: 97), the process of personal interview technique comprises of the interviewer (who is the person that ask question) and the interviewee (the one who answers question), this process is conducted generally on a face-to-face contact to the other person. The motive of the research interview is to understand the inside details, experiences, the views, beliefs and/or motivations of individuals on specific matters, and qualitative methods, such as interviews, are considered to presents a more detailed and better understanding of social phenomena (Gill *et al.* 2008: 292). The interview was conducted face-to-face, with participants. Data collected from participants is dependable since participants' holds credible academic qualification and they are in contact with children daily. Dependability in this study was achieved by providing a comprehensive description of the context in which the research is carried out, providing a description of the research method and the findings, using multiple data sources and the use of coding to analyse data which was gathered. To ensure dependability of findings in the current study, the researcher will employ an exploratory qualitative design to allow participants with rich information about the phenomenon to express themselves freely to the open--ended research questions in the interviews. The researcher will probe during the interviews to get clarity where needed. The interviews will be audio recorded and transcribed verbatim for data analysis. For analysis, the researcher will read the first interview transcript to identify themes then continue with identifying themes in the subsequent interviews until data saturation. Additionally, the researcher will verify

the analysis with the assistance of the supervisors to ensure that the findings are consistent and can be repeated when following the methodology used in the study. The findings of the study will be presented as themes.

3.10.4 Confirmability

The confirmability deals with the establishment of data and the expounding of findings that are not fabricated by the researcher's believe, but acquired evidently from the raw data (Korstjens and Moser 2018: 121). The gradation of confirming the research findings can be accomplished by incorporating an audit procedure (Brink, Van der Walt and Rensburg 2012:127). During collection of data, the researcher audio-recorded all the interviews with the permission of the participant, and transcribed the audio recording. To attain verbatim version, the interview maybe recorded with the use of audio or video recording (Coughlan 2009: 312). The audio recordings are clear and can be replayed to confirm details of the collected data.

3.11 SUMMARY OF THE CHAPTER

The chapter gave details on the research methodology that guided the study. A qualitative exploratory method was used since the inquiry explores a social or human problem. The purpose of the study was to explore radiographers' knowledge and practice in imaging children with NAI, where data was collected through interviews to attain the findings of the study. Details of processes needed to be followed, data collection, data analysis, and the trustworthiness of the study were outlined in-depth.

CHAPTER 4: PRESENTATION OF THE FINDINGS

4.1 INTRODUCTION

This chapter presents the results of interview data obtained from 10 radiographers employed by the selected public hospital within the eThekweni District in KZN province, South Africa. Data was elicited by means of semi-structured interviews which were conducted on a face to face and one-on-one with each participant. An interview guide with a list of questions that would generate data from the participants was used.

All the interviews were audio-recorded and transcribed verbatim before data analysis. The interview data were analyzed for their relevance to the research questions of the study. Firstly, the chapter describes the interviewees briefly and presents the findings of the study as themes. The chapter concludes with a summary.

The study was intended to explore radiographers' knowledge and practice in imaging children with NAI in order to develop them in this aspect and ultimately recommend training required. The research questions were:

4.1.1 Main research question

What knowledge and practice do radiographers have on imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal, South Africa?

4.1.2 Sub-questions

- a) What knowledge do radiographers have about imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal, South Africa?

- b) What are the practices of radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal, South Africa?
- c) What training is needed for radiographers to improve on their knowledge and practice when imaging children with NAIs?

An interview schedule used consisted of two sections: the first section was for the collection of demographic data, and the second contained questions that were asked by the researcher during the interview. A face-to-face interview was conducted with participants at the selected hospital. The findings presented in this chapter were interpreted in relation to literature in order to understand the knowledge and practice of radiographers when imaging children with NAI. The results of the study first described the demographics of participants in the study, and then present the key findings as themes which are discussed in terms of their subthemes.

4.2 DEMOGRAPHICS

The researcher used a homogenous purposive sampling method to select participants for the study. Participants who fulfilled the criteria, were willing to participate and have agreed to participate in the study by giving consent, were interviewed. The demographic data of the 10 radiographers who participated in the study, is depicted in Table 4.1 below. The table displays participants in terms of age group, gender, ethnicity, university attended, work experience, highest qualification and job rank.

Most participants were females, with eight females and two males. Their age ranged between 25 to 45 years of age, with nine as majority of participants being between the ages of 25-35 and one participant between 36-45 years of age. There were seven African and three Asian participants. Nine participants had graduated at DUT while one at TUT. Eight had N. Diploma in Diagnostic Radiography and two had graduated with B.Tech in Diagnostic Radiography. The participants' work experience ranged between 1 to 15 years, where six participants had work

experience of 1-5 years, three participants had 6-10 years and in one participant work experience was 11-15 years. With regards to job ranking, one participant was a chief diagnostic radiographer, while nine were Grade 1 diagnostic radiographers.

Table 4.1: Demographic data of study participants

Participant no.	Age Group (years)	Gender	Ethnicity	University Attended	Work experience (years)	Highest Qualification	Job Rank
1	36 – 45	M	African	DUT	11 – 15	N. Dip	Chief Rad
2	25 – 35	F	Asian	DUT	1 – 5	B. Tech	Rad. Grade 1
3	25 – 35	M	African	DUT	1 – 5	N. Dip	Rad. Grade 1
4	25 – 35	F	Asian	DUT	6 – 10	N. Dip	Rad. Grade 1
5	25 – 35	F	Asian	DUT	1 – 5	N. Dip	Rad. Grade 1
6	25 – 35	F	African	TUT	1 – 5	B. Tech	Rad. Grade 1
7	25 – 35	F	African	DUT	6 – 10	N. Dip	Rad. Grade 1
8	25 – 35	F	African	DUT	6 – 10	N. Dip	Rad. Grade 1
9	25 – 35	F	African	DUT	1 – 5	N. Dip	Rad. Grade 1
10	25 – 35	F	Asian	DUT	1 – 5	N. Dip	Rad. Grade 1

M = Male

F = Female

DUT = Durban University of Technology

TUT = Tshwane University of Technology

N. Dip = National Diploma in Diagnostic Radiography

B. Tech = Baccalaureus Technologiae in Diagnostic Radiography

4.3 CONCEPTUALISATION OF IMAGING CHILDREN WITH NON-ACCIDENTAL INJURY

The thematic analysis that was used on transcripts elicited key concepts that could be identified from the data. The following five themes emerged during data analysis:

- a) knowledge of NAI in children;
- b) care of children with NAI;
- c) practice when imaging children with NAI;
- d) quality of images in children with NAI;
- e) acquiring knowledge of NAI in children.

These themes are relative to each other, and assist in realising the participants' knowledge and practice when imaging children with NAI as per the interviews conducted. These formed the main themes of the study (Table 4.2). In the following section, the researcher presents each theme and its related subthemes. To justify the developed theme and subtheme, the quotations derived from the transcribed interviews are used. A sample of an interview transcript is provided (Appendix 10).

Table 4.2: Summary of themes and subthemes that emerged from data analysis

Theme	Subthemes
4.3.1 Knowledge of NAI in children	<p>4.3.1.1 No knowledge of NAI in children.</p> <p>4.3.1.2 Cannot differentiate between NAI and accidental injuries in children.</p> <p>4.3.1.3 Associate NAI with pathological fractures.</p>
4.3.2 Care of children with NAI	<p>4.3.2.1 No special care.</p> <p>4.3.2.2 Treated the same as any other child with accidental injuries.</p> <p>4.3.2.3 Compassionate, patient and kind.</p> <p>4.3.2.4 Do not know of any special care.</p> <p>4.3.2.5 Involve matron and social services.</p> <p>4.3.2.6 Do not provide special care as NAI cannot be identified.</p>
4.3.3 Practice when imaging children with NAI	<p>4.3.3.1 Follow doctor's x-ray request.</p> <p>4.3.3.2 Report to the radiologist first before taking x-ray films for NAI.</p>
4.3.4 Quality of images in children with NAI	<p>4.3.4.1 Placement of left and right lead markers. Adjustment of exposure factors.</p> <p>4.3.4.2 Ensure correct contrast and density and that the images are not blurred due to movements.</p> <p>4.3.4.3 Provide chain of evidence.</p>
4.3.5 Acquiring knowledge of NAI in children	<p>4.3.5.1 Policies</p> <p>4.3.5.2 Protocols.</p> <p>4.3.5.3 In-service training.</p> <p>4.3.5.4 Procedures.</p> <p>4.3.5.5 Specific guidelines.</p> <p>4.3.5.6 Experience.</p>

4.3.1 Knowledge of NAI in children

The majority of participants had different understandings and perceptions of NAI in children. When providing information on knowledge of NAI, they indicated that they have no knowledge of NAI, cannot differentiate between NAI and accidental injuries in children and others associated NAI with pathological fractures. The following excerpts illustrate this (all extracts presented verbatim):

“...mm. Be not certain as to how we would see a child as a radiographers that has a non-accidental injury.” **Participant 2, 25-35, female.**

“...Personally I wouldn't know, like if I wasn't told, like I cannot just look at the child and say this was not an accidental injury, so personally I wouldn't know the difference.” **Participant 5, 25-35, female.**

“...Unless it's a pathological non-accidental injury that the only way we would know but otherwise we most of the time we almost never know unless it is stated by the ordering physician or the doctor its stated by the doctor otherwise most of the time we don't ever know.” **Participant 7, 25-35, female.**

4.3.2 Care of children with NAI.

Dealing with NAI suspected case in children involves a lot of emotions for both the radiographers and the victim. When participants were asked about what they would do if a child had NAI, most mentioned different emotions that they show when caring for these children. The following quotes confirmed this:

“...I don't know how far as a radiographer you can go. All cases of injury on children presented for radiographic imaging are treated with no special treatment.” **Participant 2, 25-35, female.**

“...Well, every child I treat it's how I treat a trauma children. We just do the x-rays and give them to the doctor.” **Participant 6, 25-35, female.**

“...I think you need to be patient with the child, so your patience comes first and you need to communicate very well and also you have to be mindful that the child might be scared, the child might be disorientated, so you need to be very calm, kind and compassionate when dealing with the child and you need to be comforting.” **Participant 7, 25–35, female.**

“I don’t know how far as a radiographer you can go but, that’s as far as we as radiographers do just be gentle with the child and handle them with care and fragility.” **Participant 8, 25–35, female.**

For the same question, few participants responded that they would involve higher management, while others did not know how to provide care when the child has NAI. The following illustration asserted this:

“...Alert the manager who can maybe call the matron and social services.” **Participant 9, 25–35, female.**

“...many of us that don’t know about this, and like maybe there is a better way we can handle this patients if we are able to identify them.” **Participant 5, 25–35, female.**

4.3.3 Practice when imaging children with NAI

Most interviewees were not sure of their role and responsibility when imaging a child with suspected NAI. They concentrate on their clinical duties of imaging as a primary requirement because it is not their duty to do an investigation, they do not have anything more to do and do not feel a need to do more. The excerpt below affirms this.

“...As a radiographer I only do the x-rays because I don’t do any investigation.” **Participant 1, 36–45, male.**

“...As a radiographer per say, we do not have much of actions to take if a child has non-accidental injury, except doing x-ray as per doctor’s request.”

Participant 3, 25–35, male.

“.... I gave the x-rays which either confirm or it didn’t confirmed his suspicion but on my side there’s nothing I did or I feel I could have done.”

Participant 4, 25–35, female.

Very few interviewees indicated that they would report to the radiologist, then take some views for NAI in children. The following extract supported this:

“...I think you report to the doctor in the department and take some views for NAI in children.”

Participant 10, 25–35, female.

4.3.4 Quality of images in children with NAI.

These participants commended good radiographic practice to overcome the challenge of image quality on a NAI cases. They perceived quality to be demonstrated when there is a placement of Left and Right lead markers, correct contrast and density to show fractures, and there is a series of films to show evidence of NAI. These are described as follows:

“...It is very important that in terms of lead makers you always make sure to include those, because all those contribute to the image being diagnostically acceptable or not. Also, you put every details, your contrast, your kV’s or all exposure factors, you must be able to play around with them, so that at the end of the day you produce a diagnostically acceptable image.”

Participant 3, 25-35, male.

“...Looking at your density and contrast, looking to see if any fractures are visible or if there is like movement because kids generally move.”

Participant 9, 25-35, female.

“...But in this case because is to establish a chain of evidence and it’s evidence require; we must be as thorough as possible.” **Participant 4, 25-35, female.**

4.3.5 Acquiring knowledge of NAI in children

Participants’ highlighted lack of information and the absence of protocols make things to be difficult to deal with a suspected NAI case. They further added that the pressure of attending a case without knowing what to expect, and/or steps to follow, can be burdensome. They mentioned various ways in which they can acquire knowledge to assist them towards improving their knowledge and practice when imaging children with NAI.

“It is very significant to know policies and protocols in the area where radiographic/radiologic service is being provided. We do not even have a protocol for non-accidental injury.” **Participant 3, 25-35, male.**

“...I am not too sure, but currently there is no training that is taking place that I know of, but it would be a good idea if we would have such training and ‘erm’ basically if we could be trained and have protocols and all those procedures as to what we do when are dealing with children with NAI.” **Participant 8, 25-35, female.**

“There is no specific guidelines given to us on how we treat a patient like that, even as a student. it’s something you gain with time and experience and in generally is something you do as, in your own view from your own heart how will you treat this person.” **Participant 4, 25-35, female.**

“...In my department I never heard of any procedure, we do not have a procedure dealing with non-accidental injury”. **Participant 6, 25-35, female.**

4.4 SUMMARY OF THE CHAPTER

It is crucial for radiographers to have knowledge of NAI in children so that they can adhere to good practice in order to demonstrate evidence of abuse. However, the findings in this study showed that radiographers lack knowledge of identifying NAI in children and therefore their practice in demonstrating fractures in these children is compromised. Participants believe that their practice could be improved if they had policies, departmental protocols, in-service training, procedures, and specific guidelines. They also believed that their knowledge and practice would improve with experience. The aim of the study was to explore and describe the knowledge and practices of radiographers when imaging children with NAI at a public hospital in KZN Province. Five main themes and subthemes emerged during the data analysis. Chapter Five discussed the findings of the study.

CHAPTER 5: DISCUSSION OF FINDINGS

5.1 INTRODUCTION

The previous chapter presented the findings of the study. These findings will now be discussed based on an analysis of the data, and the subsequent expounding of the knowledge and practices of radiographers when imaging children with NAI workplace at a selected public hospital. To analyse the data, the researcher familiarised himself with the interview transcripts, and highlighted significant statements which elaborated aspects of the knowledge and practice, a technique known as horizontalisation (Creswell 2014: 241-243). These statements were used to derive an essential invariant structure, which focused on common knowledge and practice of radiographers with regard to imaging children with NAI (Creswell 2014: 241-243).

This chapter presents the discussion of the findings of interview data obtained from 10 radiographers employed by a public hospital within the eThekweni District. The interview data were analysed for their relevance to the research questions of the study. All views were gathered from the interviews were analysed using Tesch's eight steps of thematic analysis as described in Creswell (2009: 186). The chapter begins by describing the interviewees briefly, then presents the findings of the study as themes. The chapter concludes with a summary.

Lastly, the chapter reconciled the findings with the aim of the study and consolidated it with literature review. The aim of the current study was to explore radiographers' knowledge and practice in imaging children with NAI in order to develop them in this aspect and ultimately recommend training required.

5.2 DEMOGRAPHIC PROFILE OF STUDY PARTICIPANTS

All participants involved in the study were permanently employed at the selected regional hospital in KZN in the eThekweni District. They were registered with the HPCSA under the Radiography and Clinical Technology as diagnostic

radiographers. The findings of the study showed 60% with work experience of 1-5 years; 30% with work experience of 6-10 years, and 10% with work experience of 11-15 years. The findings are 10% (1-5 years of work experience) more than the findings by Rigney and Davis (2004: 8) on the role of diagnostic radiographer in imaging children with NAI. The study of Rigney and Davis (2004: 8) showed 30% participants with 22-27 years of work experience, displaying higher experience than participants on this study, with less than 20 years of work experience. The interviews indicated that, irrespective of how long the radiographer has been qualified, neither the job level had shown less amount of knowledge and practice the radiographers had on NAI, were two interviewees had a gap of over 15 years of experience (Rigney and Davis 2004: 9).

The participants of the study that aged 25-35 years were 90%, and participants aged 36-45 were 10 percent. The 80% of the participants were females; while 20% of the participants were males. The ethnicity in the study reflected 40% of the participants were Asians, and 60% of participants were Africans. In this study, the results displayed 90% of the participants were Grade 1 diagnostic radiographers; 10% of participants were chief radiographers. Participants were all registered with HPCSA, and 100% of the participants registered in the category of diagnostic radiography. Rigney and Davis (2004: 8) study showed 60% of the participants were radiographers; 10% of the participants were senior 1; 10% of the participants were senior and 10% of the participants were superintendent.

The demographic results of the study showed 40% of participants have a work experience of 6-15 years. The study of Rigney and Davis (2004: 8) reflected that 40% of participants had work experience of 9-27 years. The current study and the study of Rigney and Davis (2004: 9) showed identical results, namely that the interviews indicated different views pertaining to knowledge of signs of abuse, radiographic appearance that suggests possible abuse, which becomes more challenging to radiographers to be able to detect NAI in children.

5.3 DISCUSSION OF THEMES

The current study explores the knowledge and practice on imaging children suspected with NAI. Interviews were conducted with radiographers to provide their knowledge on how they carry out the practice based on individual experience in the profession. Themes that emerged from the study are discussed in detail below.

5.3.1 Knowledge of NAI in children

When the participants were asked about their knowledge of NAI in children, their perception and understanding differed. Participants indicated that they had no idea what NAI was or how to classify suspected patients without being alerted by the physician. The uncertainty escalated to the point where participants are reportedly unable to differentiate pathological, accidental, and NAI. Rigney and Davis (2004: 11) suggest that all radiographers require training on NAI, it is deemed necessary irrespective of not being in contact with children on a regular basis.

One of the participants had associated NAI in children with pathological fractures, where maybe injuries are severe, and accompanied by fractures. According to participants, patients with a suspected NAI and a trauma case are treated the same since they are unable to differentiate accidental injury and NAI. In this study, participants emphasize that it is a challenge to deal with NAI since they lack knowledge and they cannot confidently identify a NAI patient. Sudbery *et al.* 1997: 19) highlight that radiographers evaluate radiographic images, to assess diagnostic quality, therefore; the ability to detect signs of NAI on a radiograph will help the radiologist to make an informed diagnostic decision timorously with the child still in the radiology imaging department. This makes it easier to obtain additional images at the discretion of the medical staff.

Due to a lack of knowledge about NAI, participants needed to learn and understand different phases of accumulating evidence by simply applying good radiographic practice. It is imperative for them to know and understand the significance of evidence and information extracted from the radiographic images in children with NAI because this could be beneficial to children who are victims of NAI. According

to Hogg *et al.* (1999: 128) radiographers have the access to evaluate the physical appearance of the child and radiographic appearance, placing them at an vital area to be able to detect possible NAI in children. In addition; radiographers are at a better position to listen and observe the interaction of the child and the escort, were possible disclosure of neglect and verbal abuse maybe noted. A non-accidental injury (NAI) in children usually present to the emergency department as an accidental trauma with an occult fracture that is suspicious due to signs that indicates physical abuse and the history that does not correlate with the presenting injury (Hardy and Boynes 2003: 192). According to Ebrahim (2008: 5); patient's presentation and the doctor's assessment report could assist the radiographer with the selection of the correct protocol that will enable the radiologist to make an informed decision about imaging modality and radiographic imaging views. The researcher believes that radiographers lack knowledge of detection of NAI in children as suggested by the results of the interview.

5.3.2 Care of children with NAI

A question of how you treat a NAI suspected case reflected different emotions, and some participants do not believe these cases deserve special treatment. According to Rigney and Davis (2004: 8), professionals need to separate their personal emotions when imaging children with suspected child abuse. The same author maintained that, radiographers should equip themselves with knowledge on how to care for children that are victims of NAI. This will able them to provide the best possible integrated service that includes; law enforcement, emotional care and the physical well-being of these children. Ultimately, they will be able to detect and report suspicious cases of abuse to the relevant authorities.

Hancock *et al.* (1997: 286) further indicate that a child-sensitive approach requires particular facilities, staffing arrangement, and skills. It is advantageous for radiographers to be in a unique situation that may help to successfully detect NAI and a good position to start child protection process (Hogg *et al.* 1999: 128).

Several participants indicated that they do not know how to handle and treat a child suspected of NAI. Hogg *et al.* (1999: 127) confirm that radiographers are always pressured to confidently detect NAI without any formal training on child protection matters. All illegal observations including suspected child abuse have to be reported to radiography manager, referring medical officer and relevant law enforcement agency. Hogg *et al.* (1999: 127) state that; radiographers must report any suspicious child maltreatment to the relevant authorities, once all relevant information is handed over, the radiographer must give the child protection unit a chance to investigate and process the evidence. According to Hogg *et al.* (1999: 127), health care professionals and social workers are mandated to care and protect children against any form of abuse. The main objective is to provide protection to children against abuse, rather than treating injuries caused by physical injury and radiographers must portray safety practices on a daily basis (Rigney and Davis 2004: 8). However, Hogg *et al.* (1999: 127) highlight that radiographers' knowledge of child protection has previously been reported as inadequate.

Participants acknowledge and recommend the involvement of other practitioners, such as social workers, psychologists, and law enforcement, for intervention. Caregiver's maybe stigmatised due their expression of guilt, distress and anger, it may never be concluded at any point that parent or caregiver is abusing the children (Simon *et al.* 2017: 3). Thorough diagnostic imaging procedure, professionalism and non-judgemental manner need to be maintained at all time. People react differently when they are angry, in shock or hostile attitude, it may not be mistaken with guilt of child abuse or, a defensive mechanism to hinder action of violence to children. Davis and Reeves (2009: 206) acknowledge that radiographers may not pay attention at all times and treat the injured child as an accidental trauma, were clinicians are not alerted of possible abuse and it is important to treat all injured cases as a possible NAI in children. Hancock *et al.* (1997:284) recognise multidisciplinary intervention with major stakeholders with roles in child protection, including social, emotional and legal context for more than the efficient processing of cases. According to Hancock *et al.* (1997:284); radiographers will be helped to play a sensitive part in the process of child

protection if they have an outline knowledge of the multidisciplinary procedures. Child protection intervention requires teamwork, documentation and the need to act timeously.

One of the participants highlighted that the referring doctors from trauma unit do not share the suspicion through the investigation and the request form is very brief, with little or no evidence of abuse that alert radiographers. Therefore, radiographers will continue to treat all accidental and non-accidental injury as trauma cases, due to a lack of communication amongst multidisciplinary team that has to protect children. Other participants stated that, in cases where they are aware of a suspicious NAI case, they report to the radiologist, pediatrician or the referring physician and enquire about the required views. Brown and Henwood (1997: 207) suggests that, radiographers need to have competitive knowledge of NAI when assessing radiographic images, in considering safety and confirmation of the diagnosis, skeletal survey for NAI to be performed during working hours. Even though a child presents with minor injury, it should be dealt with immediately to rule out abuse and maybe prevent the recurrence of abuse.

5.3.3 Practice when imaging children with NAI

Participants are uncertain of their role when imaging children who are suspected NAI, but they are still expected to produce good radiographic images. Radiographers in this study believe that it is the ultimate responsibility of the nurses and doctors to ensure safety and carry out the diagnosis of NAI and their primary duty is provide radiographic images when necessary for doctors to make a diagnosis. According to Jain (2015: 33); it is important to emphasise that radiographic diagnostic imaging plays a vital role in the detection of NAI, the extent of injuries, identification of fracture mechanism and ruling out of possible child molestation and detecting other pathologies.

Radiographers are equipped academically and through clinical experience on how to identify pathological fractures and accidental fractures, but it challenges radiographers when they need to differentiate NAI from accidental trauma and

pathological fractures on children suspected of NAI. Furthermore, participants have stated that they depend on clinicians to assess the patient and refer the patient with a request form for radiographic examination. Davis and Reeves (2009: 206) confirms that it has been a traditional role for a diagnostic radiographer is to perform a required radiographic examination to acquire quality diagnostic images that enable the referring physicians and the radiologist to make an adequate diagnosis.

The participants have voiced out their concern that doctors will have the knowledge that the patient is a NAI suspected case, but not communicate accordingly with other medical team members, especially radiographers. When participants are asked, “what do they do when a child has NAI”, a majority responded by saying it is the responsibility of the doctor to diagnose and treat patients with NAI. Participants further indicated that because they don’t do further investigation, they just follow the doctor’s orders by imaging the patients, and never bother about the doctor’s findings. According to the rules set by HPCSA in Health Professions Act of 1974, section 56 (Department of Health 2016: 27), radiographers will only perform radiographic examinations that are requested by a medical officer. This rule limits radiographers to do any additional views on a suspected NAI case, as they need to follow the orders on the x-ray request form.

Although the study indicated a lack of knowledge of practice, some participants highlighted important skills such as possible views to be acquired, as well as how an individual should conduct themselves before the alleged abuser and the child. According to Hogg *et al.* (1999:127), radiographers are needed to acquire a skill that will enable them to initiate a medical investigation by following the correct process and being able to detect NAI in children. Participants have highlighted that their primary responsibility is to provide radiographic images for the doctor to diagnose. One participant in the study of Rigney and Davis (2004: 9) as a senior radiographer said that, radiographers do come across incidents of possible physical abuse but they will not report these incidents even if the child disclose the abuse.

The role of a radiographer is not understood by participants on a suspected NAI case by further emphasising on the interview that, they are not sure how far they maybe involve before and after radiographic examination. Other participants recognise the importance of treating cases of suspected NAI sensitively, by taking into consideration the feelings of the victim. Participants acknowledge the need to act responsibly, and recognised the need to involve radiologists, managers, and psychologists. Even though there are mixed emotions about how to treat an NAI case, some participants think radiographers need to improve communication with the patients, as well as treat them with care and fragility to easy tension with the patient. Other participants indicate that recognition of a NAI in children, imaging and handling kids with NAI comes with experience as radiographer interact with several cases. The radiographer will normally learn procedure that is preferred by the clinician or radiologist, and share information with other radiographers when the procedure is required.

One of the participants indicated the concern that there are many radiographers who do not know about NAI, how to identify a suspected NAI case, and a better way to handle those patients. It is imperative to know and understand NAI as a radiographer, in order to have a way to deal with challenges pertaining knowledge, handling of patients, and radiographic imaging, by receiving the relevant training. Rigney and Davis (2004: 11) recommend training on NAI to be initiated and be extended to all other professions, especially those who work closely with children for early detection and diagnosis of abuse. The same author believes that training may help radiographers to identify possible signs and symptoms of child abuse and gaining enough knowledge that assist clinicians in other hospitals were radiologist are not available.

Detection of NAI in children by radiographers is not the only challenge, but they are required to acquire radiographic images as their responsibility, document evidence, report suspicious observations, and follow legal protocol available. Radiographers are in constant contact with children during radiographic examination, but a special training that covers NAI is required since it is a challenge to recognise possible abuse that can be prevented (Rigney and Davis 2004: 11).

A reminder Hogg *et al.* (1999: 127-127) indicate that, radiographers need to take accountability within their radiographic practice, and therefore, safety and well-being of all patients under your care take a priority. Every country has a constitution that protects all citizens, including the rights and protection of children against, physical harm, maltreatment and neglect (Jamieson and Lake 2013: 24).

Regardless of challenges faced by radiographers with NAI in children, in terms of Section 110 of the Children's Act, Act 38 of 2005 the following applies:

- All professionals are liable for child protection including; radiographers, medical practitioner, psychologist, legal practitioner, social service professional, dentist, religious leader, traditional leader, teacher, nurse, etc., are required to inform a designated child protection unit in case of suspicious act of any kind of abuse.
- Department of social development, a designated child protection organisation, in support of other organisations with a primary goal of protecting children, by reporting to the law enforcement department (KwaZulu-Natal Department of Education 2010: 18).

5.3.4 Quality of images in children with NAI

A radiographic image quality commended good radiographic practice on a case of NAI by participants. According to participants, for a diagnostic radiographic image, radiographers need to ensure good radiographic technique, exposure factors, collimate the x-ray beam to the area of interest, and a visible anatomical marker. This participant highlight a fact that it is imperative to ensure good quality images for NAI, in order to establish a chain of evidence to eliminate or prove NAI in children. This finding is supported by the study of Rigney and Davis (2004: 8) by emphasising that the justification of radiographic imaging for suspected NAI is to gather significant evidential documents for legal child protection proceedings.

Lead makers are metal makers that help identify the sides that are being imaged and the projection (AP or PA) that is displayed on the radiographic image. Brown and Henwood (1997: 207) indicate that all lead makers must be placed within the area exposure and should be visible on the radiographic image without obscuring

the area of interest. Where anatomical structures or injury is demonstrated, the implication of radiation dose needs to be assessed in case of repeating the examination. The same author further states that the appearance of bony details on a radiographic image is essential for adequate diagnosis, with minimal or no error being accommodated.

An exposure chart for paediatric examination needs to be clearly identified with all necessary details such as, projections, Good exposure charts for children are essential, clearly marked with all necessary details such as projections, x-ray beam positioning, accurate radiographic exposure for specific area of interest must be included (Brown and Henwood 1997: 205). At the university and during clinical training, radiographers are taught good radiographic technique, radiographic exposure and placement of anatomical makers. A majority of the participants insisted on good radiographic positioning to avoid repeats that ultimately results to overexposure to children.

Tiyyagura *et al.* (2017: 16) and Aertsen (2017: 1) recommends several radiographic projection, such as: AP/PA, lateral and oblique views chest, abdomen, skull, long bone and spines to assess the patient and rule out lesions and fractures that are of a resemblance to the inflicted injury. When participants were asked to identify radiographic examinations required for children suspected NAI, the majority indicated that they are not aware as to whether there is any special for examination for NAI, but they follow radiographic orders from the referring clinician.

One of the participants stated that they treat all paediatric traumas like accident but perform additional views (e.g. bilateral limbs) for children in order to compare both sides. Brown and Henwood (1997: 207) reveal good paediatric radiographic technique is essential to elicit NAI from other possible diagnosis that may present as an abuse. With radiographers bearing the challenge of an extremely distressed child, proper paediatric technique needs to be maintained with immobilization to be used cautiously and be considerable of psychological trauma of the child. Brown and Henwood (1997: 205) embraces that, it is important for all diagnostic

radiography qualification to cover basic radiographic technique, with an extended curriculum for paediatric radiographers.

5.3.5 Acquiring knowledge of NAI in children

According to participants, there is a lack of information pertaining clinical expectation and absence of protocols and guidelines. General concern from participants is that, without a legal guiding tool, poses a serious threat of missing alarming evidence. A majority of participants agree that it is a challenge to have to deal with NAI in children without knowledge and be expected by physician to acquire a series of images without following standard guidance. The participants believe that knowledge of NAIs in children can be acquired through the following:

- policies;
- protocols;
- in-service training;
- procedures;
- specific guidelines; and
- work experiences.

These findings are in line with those by Hogg *et al.* (1999:128) where the authors' indicated that, radiographers need to have extensive knowledge of policies and procedures, interpersonal skills and personal psychological strength in order to manage children with suspected abuse. The researcher could not find a protocol at the hospital that has been adopted for NAI in children to guide doctors in relation to imaging a suspected NAI in children. The same protocol will guide radiographers on what series of images to carry out, in order to gather necessary information to either rule out or confirm NAI.

Training on non-accidental injury in children requires an academic approach, were diagnostic radiography students would learn an alarming behaviour of an abused child, a radiography approach, procedure to be followed on a suspected NAI cases and how to report a NAI suspected case (Rigney and Davis 2004: 11). The essential part of this training will extend the use of knowledge to rural hospital and

clinics where radiographic services are provided. According to Hogg *et al.* (1999: 128), it is clear that radiographers require to be educated and trained to meet the demand of these responsibility, with child protection being part of the education curriculum, with job induction and regular updates to be integrated in the CPD programmes.

5.4 FINDINGS IN RELATION TO THE AIMS OF THE STUDY

The current study was conducted with the aim of exploring radiographers' knowledge and practice in imaging children with NAI as a selected public hospital in KZN, for the purpose of developing them in this aspect and ultimately recommending the training required. The aim of the study was achieved, and the themes that emerged from the radiographers' descriptions of their knowledge and practices when imaging children with NAIs included knowledge of NAI in children, care of children with NAI, practice when imaging children with NAI, quality of images in children with NAI, and acquiring knowledge of NAI in children. These findings were aligned with the concepts in the literature review. Participants in this study were interviewed and they responded to three research questions, which were based on the study's objectives. The questions, and the findings obtained are given below:

- a) What knowledge do radiographers have about imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa? In exploring radiographers' knowledge in this aspect, approximately 60% of participants indicated that they wouldn't know unless they are alerted by the referring doctor or nurses. Participants also indicated that the referring doctors do not indicate their suspicion on the request form, and the medical history is brief for radiographers to notice the inconsistency. About 20% of participants, indicated that they imagine many children to have a history of trauma and believe they might have imaged a children with a suspected NAI without knowledge.

The study found that participants lacked the knowledge of NAIs in children. Participants indicated that, they cannot differentiate between NAIs and accidental injuries in children. The uncertainty escalated to the point where

participants were unable to differentiate pathological or accidental NAI. Some also highlighted that they had no idea what NAI is, or how to classify injuries in children, without being alerted by the physician. They further stated that they treat all trauma cases the same, including suspected cases of NAI. A majority of participants highlighted that, they do not have experience on imaging children suspected of NAI and their university outcome did not address the topic.

The lack of knowledge of NAIs in children has resulted in them not providing the care required for children with NAIs. According to most participants, there is no special care for children with NAIs, and all children with trauma should be treated the same. Few participants indicated that in caring for patients with NAIs, a multidisciplinary approach ought to be adopted, and that social services should be involved in these cases. Some indicated that these children should be treated with compassion and radiographers should be patient and kind when handling them.

- b) What are the practices of radiographers when imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa? With regards to this question, the study found that all radiographers interviewed follow the doctor's x-ray request. One participant indicated that when the doctor has informed them that the child has NAI, the radiographer ought to report to the radiologist before imaging the patient. The interviewee indicated that it is a good practice to provide images of good quality. This is achieved by placing a right or left marker on the films; while ensuring that the x-ray images have the correct exposure factors in order to produce good quality x-ray images. The same participant highlighted that it is imperative to provide a chain of evidence when imaging children with NAIs.
- c) What training is needed for radiographers to improve on their knowledge and practice when imaging children with NAIs? The findings obtained in this study highlight that radiographers can acquire knowledge of NAI in children if they can be provided with in-service training and procedures to follow when

imaging children with NAIs should be in place in the departments. The participants also highlighted that there should be protocols and policies at the hospital to guide the handling of children with NAIs.

5.5 SUMMARY OF THE CHAPTER

This chapter presented a discussion of the findings of the study. The demographics profiles of participants based on the knowledge and practice, indicated that radiographers have no knowledge on how to recognise NAI in children. It is therefore challenging phase for radiographers to understand their role and responsibility. The insufficient knowledge and practice displayed by radiographers, places a limitation on the productivity pertaining detection, imaging, child protection role, legal knowledge, and interaction between the child and the alleged abuser. The acknowledgement of some of the participants, indicates that training on NAI in children is needed for all radiographers working fulltime with children and those who interact part time with children. The following chapter will conclude this research, and outline the limitations, recommendations and areas for future study.

CHAPTER 6: CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

In this chapter, the findings of the study are summarised, and the limitations as well as recommendations of the study are highlighted, and concludes with the summary. The purpose of the study was to explore radiographers' knowledge and practice when imaging children with NAI in order to develop them in this aspect and ultimately recommend training required. Information was obtained by asking the participants to respond to the following research questions:

- a) What knowledge do radiographers have about imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa?
- b) What are the practices of radiographers when imaging children with NAIs at a public hospital in KwaZulu-Natal, South Africa?
- c) What training is needed for radiographers to improve on their knowledge and practice when imaging children with NAIs?

The next section summarises the findings of the study.

6.2 SUMMARY OF THE FINDINGS

The findings of the study using Tesch's method of thematic analysis of the interview data provided five major themes, namely: knowledge of NAI in children; care of children with NAI; practice when imaging children with NAI; quality of images in children with NAI; and, acquiring knowledge of NAI in children. A more detailed summary of each theme is outlined below.

6.2.1 Knowledge of NAI in children

The lack of knowledge of NAI in children persist the act of abuse in children. Radiographers require attaining knowledge that will able them to differentiate between pathological, accidental, and non-accidental injury fractures. Acquired knowledge will help radiographers to detect a NAI suspected case using radiographic images, and minimising misdiagnoses of NAI in children. Therefore, radiography department and trauma unit need to join venture by sharing knowledge about NAI in children, from clinical examination to radiographic intervention and radiology reporting.

6.2.2 Care of children with NAI

It is crucial to treat all paediatric trauma cases with care, particularly suspected NAI cases. As radiographers gain knowledge on NAI in children, this will enable them to classify NAI cases accordingly. Radiographers also need to have psychology knowledge and training on paediatrics, for them to acknowledge signs of NAI in children, and a way to handle a child and the alleged abuser without personal emotions involved.

6.2.3 Practice when imaging children with NAI

Radiographic imaging assists doctors in diagnosing NAI and the extent of abuse where possible. Therefore, until protocols for NAI in children are set, medical officers, trauma nurses and radiographers need to constantly communicate, especially when a case of NAI case presents. Radiographers have the same responsibility as do other medical member to adhere to work ethics, scope of practice, report any suspicious acts, and to protect children from harm, as required by South African constitution.

6.2.4 Quality of images in children with NAI

A good radiographic practice is taught at the University, and practiced during clinical experiential training at the hospitals throughout the course. The acquired

knowledge needs to be practiced on every patient, where proper radiographic technique will result in good quality diagnostic images, with a chain of evidence being easy to follow. A good radiographic technique, radiographic exposure factors, placement of radiographic lead maker and knowledge of the medical condition is required. Paediatric radiography needs to be treated specially, as pathology and fractures maybe a challenge to distinguish pending on the type of pathology.

6.2.5 Acquiring knowledge of NAI in children

Radiographers are concerned that they are expected to know and understand how to handle a NAI in children without any training or guidance. Policies need to be in place to regulate how cases of NAI should be dealt with on a clinical level, ensuring proper diagnosis and steps to follow in case a NAI is confirmed. Participants indicated that the struggles of understanding NAI in children will continue, unless set protocols are in place, procedures are followed, in-service training is ongoing, and guidelines are set and updated. Radiographers will gain more knowledge and experience that will help gain confidence to detect and image children with NAI.

6.3 SUMMARY OF THE STUDY

The study illustrates the challenges faced by radiographers pertaining lack of knowledge regarding NAI in children. The lack of knowledge included detection of NAI, what NAI in children entails, how to handle NAI, the difference between NAI and trauma, and who is responsible for handling and documenting NAI cases in the radiography department. The ability to differentiate between NAI and trauma by radiographers is vital for detection of signs of NAI on the radiographic images. This enable the radiographers to follow the protocol and procedure when imaging NAI. The study reflected a lack of involvement and communication between trauma doctors, nurses, and radiographers pertaining medical history and doctor's orders. Radiographers working in a hospital that caters for trauma radiography services are faced with a challenge to classify all paediatric trauma case to exclude NAI without knowledge and practice on NAI in children.

The challenge faced by radiographers may be eliminated with the involvement of Department of Health, Department of Justice, Higher Education and hospital service boards. Implementation of policies that provide direction as to how to deal with NAI in children will ensure the imposition of legal action to non-compliance. Protocols and procedures ought to be set, and provide a guide as to the process. It is very important for all trauma staff and radiology staff to be trained on policies, protocols and procedures for consistency and sustainability in dealing with NAI in children.

6.4 LIMITATIONS OF THE STUDY

Limitations are considered to be deficiencies of the study (Van Der Walt and Van Rensburg 2008: 118). According to Creswell (2003: 18) and Atieno (2009: 15), all processes and procedures have their own particular limitations and unfairness. Limitations stipulate the weaknesses of a study, thereby allowing a fair evaluation of the study's contribution with such limitations in mind (Rossman and Rallis 2016: 119). Alternatively, they may be viewed as restrictions of a study, which diminish its generalisability to other similar populations (Grove, Burns and Gray 2013: 598).

Firstly, the researcher used a non-probability sampling methods and pursued a purposive sampling method, where participants are selected from one hospital in eThekweni Health District area. The findings of the study can only be generalised to radiographers working at the selected public hospital in the eThekweni District.

Secondly, the quality of data collected by the researcher was significant. An extreme caution was obligatory in the process of interpreting the findings that relates to radiographers, because good qualitative research does not over-demonstrate the study findings. It is the responsibility of the researcher ensure confidentiality of the participants, pertaining to the data collected (Malterud 2001: 486).

Furthermore, the researcher found that there was limited literature on knowledge and practice of radiographers when imaging children with NAIs.

6.5 RECOMMENDATIONS

The study was conducted at a selected hospital in KZN and the recommendations intended for radiographers at this hospital are as follows:

- Updated protocols and procedures for NAI in children to be made available in the department.
- Implementation of radiographic protocols and procedures ought to follow on suspected NAI in children.
- Radiographers need to undergo departmental in-service training on NAI in children, to keep up with protocols, procedures, signs for detection, and legal procedure to follow when necessary.
- All new staff need to have a scheduled training on NAI in children, so as to ensure continuity and quality service standard of radiography.
- Radiography staff need to ensure that proper radiographic technique is sustained (correct patient name, correct lead maker, positioning, documentation, and so forth).
- The radiography department needs to document procedures and protocols to be followed when imaging children with NAI.

6.6 CONCLUSION

NAI in children involves the government sector, higher education, hospital management, as well as other health workers. Detection of NAI will lead to proper medical examination and radiographic examination, documentation, social and psychological involvement and justice to the children. Knowledge and good practice on NAI in children will also minimise misdiagnosis and gaining confidence from all involved medical staff will improve with time.

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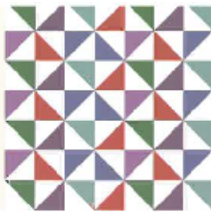
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APPENDICES

Appendix 1: DUT Ethics clearance



Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Bulembu Court
Site 1, Sibusiso Campus
Durban University of Technology
P O Box 1331 Durban South Africa, 4001
Tel: 031 312 2175
E-MAIL: eths@dut.ac.za
<http://www.dut.ac.za/eths/eths/eths.html>
www.dut.ac.za

3 May 2019

Mr O E Lekaota
708 Mokala Street
Ipelegeng Location
Schweizer-Renkke
2780

Dear Mr Lekaota

Knowledge and practice of radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal, South Africa.

The Institutional Research Ethics Committee acknowledges receipt of your gatekeeper permission letters.

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 Adim
Chairperson: IREC



Appendix 2a: Letter of permission to the KZN Department of Health



The Health Research and Knowledge Management Component
KwaZulu-Natal Department of Health
Private Bag X9051
Pietermaritzburg
3201

Dear Dr E. Lutge

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a post graduate student at the Durban University of Technology (DUT), currently studying towards Master's Degree in Radiography. My research topic is "Knowledge and practice of radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal province, South Africa". The study aims to explore radiographers' knowledge on imaging NAI in children at the selected public hospital in EThekweni District that are less than 150 km away from DUT.

Individual interviews will be conducted with qualified diagnostic radiographers, who will be selected by means of purposive sampling. Informed consent will be obtained from them to participate in the interviews. Participants will participate voluntarily and may withdraw, without fear or favour, from the study at any time. All information of the participants and your institution will be handled with confidentiality. The participants will remain anonymous and codes will be used to protect participants' identities.

I therefore request your permission to conduct my research investigation at Addington Hospital, Radiography Department. I am attaching the research proposal with the necessary information sheet and informed consent that will be provided to participants. Information acquired during this research project will be shared with all participants and organisations prior to public dissemination. Results of the study will be published in an accredited journal or a peer review journal.

Yours sincerely,

Mr O.E. Lekaota
Durban University of Technology
Email: olehile@workmail.co.za

Appendix 2b: Approval letter from the KZN Department of Health



health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address: 330 Leningdale Street, Pietermaritzburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/3193 Fax: 033 394 9732
Email: info@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:

Health Research & Knowledge
Management

NHRD Ref: <Z_201904_013

Dear Mr CE Lckocka
Durban University of Technology

Approval of research

1. The research proposal titled 'Knowledge and practice of radiographers when imaging children with non-accidental injuries at a public hospital in KZN, South Africa' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby approved for research to be undertaken at Addington 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 hikm@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: 26/04/19

Fighting Disease, Fighting Poverty, Giving Hope

**Appendix 3a: Letter of permission to the District Manager of
eThekweni Health District**



708 Mokala Str
Ipelegeng Loc
Schwizer-Reneke
2780

The District Manager
EThekweni Health District
P/Bag X54318
Durban
4000

Dear Mrs P. Msimango

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a post graduate student at the Durban University of Technology (DUT), currently studying towards Master's Degree in Radiography. My research topic is "Knowledge and practice of radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal, South Africa". The study aims to explore radiographers' knowledge and practice on imaging NAI in children at the selected public hospital in EThekweni District, KwaZulu-Natal province.

Permission have been granted by the KwaZulu-Natal Department of Health to conduct the research. In order to conduct this study, your permission is requested to conduct individual interviews on diagnostic radiographers at your public hospital in EThekweni District. Participants will be selected by means of purposive homogenous sampling and informed consent will be obtained from them to participate in the interviews.

Having access to your institution would be of great importance to complete the study. The interviews will be conducted at Radiography Department at Addington Hospital. I therefore request your permission to conduct my research investigation at your facility. I am attaching the research proposal with the necessary information sheet and informed consent that will be provided to participants. Participants will participate voluntarily and may withdraw, without fear or favour, from the study at any time. All information of the participants and your institutions will be handled with confidentiality. The participants will remain anonymous and codes will be used to protect participants' identities.

Information acquired during this research project will be shared with all participants and organisations prior to public dissemination. Results of the study will be published in an accredited journal or a peer review journal.

Yours sincerely

Mr O.E. Lekaota
Durban University of Technology
Email: olehile@workmail.co.za

Appendix 3b: Approval from the District Manager of eThekweni Health District



DIRECTORATE: CORPORATE SERVICES

ETHEKWINI HEALTH DISTRICT OFFICE

83 King Celswayo Highway
Mayville, Durban, 4001
Tel: 031 240 5455 Email:
www.kznhealth.gov.za

12th April 2019

Dear Olehile Lekaota

Re: Permission To Conduct Research at eThekweni District Facilities.

This letter serves to confirm that your application to conduct the research study titled "The clinical challenges experienced by newly qualified sonographers in the workplace in the eThekweni District." in the eThekweni district at the following health care facilities has been recommended:

1. Addington 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)
eThekweni Health District

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 4a: Permission letter to the CEO of the hospital



708 Mokala Str
Ipelegeng Loc
Schwizer-Reneke
2780

The Chief Executive Officer
Addington Hospital
P.O. Box 977
Durban
4000

Dear Sir /Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a post graduate student at the Durban University of Technology (DUT), currently studying towards Master's Degree in Radiography. My research topic is "Knowledge and practice of radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal province, South Africa". The study aims to explore radiographers' knowledge on imaging NAI in children at the selected public hospital in eThekweni District, KwaZulu-Natal Province.

Permission have been granted by the KwaZulu-Natal Department of Health to conduct the research. In order to conduct this study, your permission is requested to conduct individual interviews on diagnostic radiographers at Addington hospital in eThekweni District. Participants will be selected by means of purposive sampling and informed consent will be obtained from them to participate in the interviews.

Having access to your institution would be of great importance to complete the study. The interviews will be conducted at Radiography Department in the hospital. I therefore request your permission to conduct my research investigation at your facility. I am attaching the research proposal with the necessary information sheet and informed consent that will be provided to participants. Participants will participate voluntarily and may withdraw, without fear or favour, from the study at any time. All information of the participants and your institutions will be handled with confidentiality. The participants will remain anonymous and codes will be used to protect participants' identities.

Information acquired during this research project will be shared with all participants and organisations prior to public dissemination. Results of the study will be published in an accredited journal or a peer review journal.

Yours sincerely,

Mr. O.E. Lekaota
Durban University of Technology
Email: olehile@workmail.co.za

Appendix 4b: Approval letter from the CEO of the hospital



health
Department:
Health
PROVINCE OF KWAZULU-NATAL

ADDINGTON HOSPITAL

P.O. BOX 977
DURBAN

4000
Tel: 031-327-2370 Email: roshmi.boodhai@czhi.health.gov.za
www.kznhealth.gov.za

OFFICE OF THE CHIEF EXECUTIVE OFFICER

Reference: 9/2/3/R

Date: 26th March 2019

Principal Investigator:
➤ **Mr O E Lekaota**

PERMISSION TO CONDUCT RESEARCH AT ADDINGTON HOSPITAL:
"KNOWLEDGE AND PRACTICE OF RADIOGRAPHERS WHEN IMAGING CHILDREN
WITH NON-ACCIDENTAL INJURIES AT A PUBLIC HOSPITAL IN KWAZULU-NATAL,
SOUTH AFRICA"

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

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 5a: Permission letter to the Head of Radiography Department



708 Mokala Str
Ipelegeng Loc
Schwizer-Reneke
2780

Head of Radiography Department
Addington Hospital
P.O. Box 977
Durban
4000

Dear Sir /Madam

I am a post graduate student at the Durban University of Technology (DUT), currently studying towards Master's Degree in Radiography. My research topic is "Knowledge and practice of radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal province, South Africa". The study aims to explore radiographers' knowledge on imaging NAI in children at the selected public hospital in EThekweni District, KwaZulu-Natal province.

Permission has been granted by the KwaZulu-Natal Department of Health to conduct the research. In order to conduct this study, your permission is requested to conduct individual interviews on diagnostic radiographers at Addington hospital, Radiography Department. Participants will be selected by means of purposive sampling and informed consent will be obtained from them to participate in the interviews.

Having access to your institution would be of great importance to complete the study. The interviews will be conducted at Radiography Department in the hospital. I therefore request your permission to conduct my research investigation at your Department. I am attaching the research proposal with the necessary information sheet and informed consent that will be provided to participants. Participants will participate voluntarily and may withdraw, without fear or favour, from the study at any time. All information of the participants and your institutions will be handled with confidentiality. The participants will remain anonymous and codes will be used to protect participants' identities.

Information acquired during this research project will be shared with all participants and organisations prior to public dissemination. Results of the study will be published in an accredited journal or a peer review journal.

Yours sincerely,

Mr. O.E. Lekaota
Durban University of Technology
Email: olehile@workmail.co.za

Appendix 5b: Approval letter from the Head of Radiography Department



HEALTH
KwaZulu-Natal

ADDINGTON HOSPITAL
P.O. Box 977, Durban, 4000
16 Erskine Terrace, South Beach, Durban, 4001
Tel.: 031 327 2525, Fax: 036 6220733
Email: Maganathan.Chetty@kznhealth.gov.za
www.kznhealth.gov.za/addingtonhospital.htm

Date: 29th April 2019

Mr O.E. Lekaota

Durban University of Technology

Permission to Conduct research at Addington Hospital Radiology Department: "knowledge and practice of Radiographers when imaging children with non-accidental injuries at a public hospital in KwaZulu-Natal, South Africa"

Permission has been granted to Mr O.E.Lekaota to conduct his research at Addington Hospital Radiology Department. Mr O.E. Lekaota is to provide the department with the schedules of his visit. It is compulsory for Mr O.E.Lekaota to adhere to all Department of Health Code of Conduct, policies, procedures, protocols and guidelines during his time at Addington Hospital Radiology Department.

Yours Sincerely

Mr. M. Chetty

Assistant Director: Radiography

uMnyango Wezemple - Departament van Gesondheid
Fighting Disease. Fighting Poverty. Giving Hope

Appendix 6: Letter of information for participants



Dear Participant,

I would like to welcome you to my research study and thank you for your interest and participation.

Title of the Research Study: Knowledge and practice of radiographers when imaging children with non-accidental injuries at public hospitals: A qualitative study in KwaZulu-Natal Province, South Africa.

Principal Investigator/s/researcher: Olehile Lekaota, B.Tech Radiography: Diagnostic

Co-Investigator/s/supervisor/s: Dr. B. Nkosi, PhD in Health Sciences

Brief Introduction and Purpose of the Study: The purpose of the study is to explore radiographers' knowledge and practice on imaging children with NAI in order to develop them in this aspect and ultimately recommend training required. The study will empower radiographers with knowledge in imaging children with NAI and therefore help to reduce the rate of misdiagnoses in these children. Radiographers will acquire skill on pattern recognition of NAI and assessment of history behind injury to help suspected cases of abuse.

The data will be collected through audio recording during the interview session. The interview will be approximately 30 - 45 minutes in duration. The participant simply required to provide answers to the interview questions. Only diagnostic radiographers with one year experience after community service, and permanently employed by eThekweni Health District under KZN Health Department.

Outline of the Procedures: If you are willing and have signed the letter of informed consent, an interview will be set up at your convenience, and will take place your workplace during your lunch break.

Risks or Discomforts to you: There are no risks/discomforts involved from your participation in this study.

Benefits: This study will be useful to the Radiography Department as the findings may result in the modification and improvement in the current curriculum, enhancing "radiography students" experience of their clinical environment.

Remuneration: Participation in this research study is voluntary and no remuneration will be awarded.

Costs of the Study: Participants will not incur any costs by participating in this research study.

Confidentiality: The details and information obtained through the interview process will be treated with utmost confidence. Personal identification details may be required; in that case the identity of participants will only be known to the researcher. You may withdraw your participation of this study at any time.

If you have any further queries, please do not hesitate to contact me or my supervisor. Your time, opinions and assistance in this study is invaluable and greatly appreciated.

Persons to Contact in the Event of Any Problems or Queries

Please contact the researcher Olehile E. Lekaota on 0738302884 and my supervisors Dr. B. Nkosi on 031 373 2509 or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support, Prof S Moyo on 031 373 2577or moyos@dut.ac.za

Appendix 7: Consent

Consent form



Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____, 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
Thumbprint**

Date

Time

Signature/Right

I, _____ (name of researcher) herewith confirm that the above participant has been

Fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	Date	Signature

_____	_____	_____
Full Name of Witness (If applicable)	Date	Signature

_____	_____	_____
Full Name of Legal Guardian (If applicable)	Date	Signature

Appendix 8: Demographic data for the interview participants



Circle the response that represents the most accurate description of your individual professional profile.

Tick [X] appropriate box:

1. Age in years:

Under 25	
25 - 35	
36 - 45	
46 - 55	
56 - 65	

2. Gender:

Female	
Male	
Other	

3. Race:

Caucasian(white)	
Asian	
Black	
Other	
I do not wish to include this information	

4. University Attended (name, city, state located):

5. Work experience (years)

1 – 5	
6 – 10	
11 – 15	
16 – 20	
21 - 25	
26 and above	

6. Qualifications

Supplementary	
Diploma	
B. Tech Degree	
Master's Degree	
Doctoral	

7. Rank

Grade 1	
Grade 2	
Grade 3	

Appendix 9: Interview guide



Questions on children with non-accidental injuries

1. What do you understand by the term NAI?
2. How do you know that a child has NAI?
3. What do you do when a child has NAI?
4. What skill do you require in handling children with NAI?
5. What radiographic examination do you perform when a child has suspected NAI?
6. How do you know which examination to perform?
7. How do you know that the radiographic images are of acceptable standard?
8. What are the protocols and procedures to follow when dealing with a child with suspected NAI?
9. What training do you require in imaging children with NAI?

Appendix 10: Sample of the interview transcript

Interviewer: Olehile E. Lekaota

Participant: 1

Date: 15//05/2019

Time: 08:35 am

Place: Hospital: X – Ray Department

Transcription:

Interviewer: Please tell me what you understand about the term non–accidental injury?

Participant: I presume the term non–accidental injury is defined by (.) having a (.) a non physical injury ((erm)) maybe something that's ((erm)) pathological or it could also (.) be defined as (.) something that's happened to a patient or an individual ((erm)) with regards to (.) born with deformity and has an effect on the patient or individual ((erm)) regards to injuries ((er)) later in their life's

Interviewer: Is that all

Interviewer: Ok. And how do you know that a child has non–accidental injury?

Participant: 'mm' (.) Be not certain as to how we would see a child as a radiographers that has a non–accidental injury, we are told by the doctor that's requesting the x–rays that has already assessed clinically assessed the patient.

Interviewer: Ok. And what do you do when a child has non–accidental injury?

Participant: 'mm' (.) You treat the patient as if it is not an accidental injury 'erm' like I said we can't define what's a non–accidental injury so we don't know weather if it is non–accidental injury or accidental.

Interviewer: Oh ok. And what skill do you require in handling children with non-accidental injury as a radiographer?

Participant: Skill (.) you have to be patient with the patient 'erm' you have to at least know how to (.) 'erm' what sort of x-ray is required for non-accidental patients, you know how to handle a patient physically, you need to know positioning, you know not to injure the patient anymore.

Interviewer: Ok thank you. What radiographic examination do you perform when a child has suspected non-accidental injury?

Participant: ((pause)) I presume you x-ray the (.) when you doing examination, radiographic examination of the area of interest (.) and not radiating the entire baby or the entire child.

Interviewer: And how do you know which examination to perform?

Participant: 'erm' obviously it depends on the part of interest, 'erm' the view that are requested 'er' like I said we are told by the Radiologist or the doctors that clinically assessed the patient. As radiographers we determine our 'mm' radiographic examination according to what has been stated on our request forms.

Interviewer: Alright. (.) And how do you know that the radiographic images are of acceptable standard?

Participant: We treat this as every radiographic image 'erm' basically (.) 'erm' if you can understand what is happening on the radiographic image then the radiologist will as well, so you treat it as a normal x-ray as from a (.) a trauma 'erm' accidental or a normal 'erm' everyday x-ray 'erm' (.) basically it has to be a statically and diagnostically acceptable.

Interviewer: ok. And what are the protocols and procedures to follow when dealing with child with suspected non-accidental injury?

Participant: protocol and procedures to follow (.) 'mm' I would presume that (.) the child would have to (.) firstly see a doctor, 'erm' if they haven't already, and they should follow medical procedure thereafter, 'erm' after seeing a paediatrician,

paediatrician will determine whether that child require x-ray, child go for x-ray, if child need further treatment afterwards.

Interviewer: And departmentally, how do you do, deal with it?

Participant: Departmentally in the x-ray department?

Interviewer: Yes

Participant: In the x-ray department we treat 'er' non-accidental injuries as accidental injuries. So basically we treat the patient as a trauma patient, 'erm' (.) we have to be really quick with our x-ray because all trauma are (.) sort of high risk 'erm' with regards to their injuries, so we need to quick with our x-rays 'erm' also we have be (.) quick but (.) 'erm' careful with the patient not injure the patient any further. 'erm' (.) If we can, we'll generally we give children (.) 'er' preference in x-ray. So non, especially with non-accidental injury, as a child we give preference to the patient, so, patient will go first for x-ray, be very careful with the patient, treat the patient 'erm' with extra care actually because (.) 'er' obviously it's a child. (.) Take the x-ray straight to the radiologist, preference there as well 'erm' and explain that it is a child that has non-accidental injury. 'er' Like I said our department we treat as a trauma patient, so it will also be done very quick.

Interviewer: Ok. And what training do you require in imaging children with non-accidental injury?

Participant: 'erm' What training do you require? 'mm' I presume you need to know how to handle a child 'erm' children and adults are too different. Some children don't understand 'erm' what are you explaining or the request that you have from them. So, firstly I think we need to establish the language barrier firstly, so we know how to communicate with the child 'erm' also 'erm' regards to positioning a child sometimes can be a bit different, it require an adult to assist with the x-ray 'erm' (.) what else (.) training (.) 'mm' training for a child ((pause)) yah.

Interviewer: Ok. Just an additional question I have, 'erm' what do you think the (.) is the importance of radiographers learning about non-accidental injury?

Participant: I think it is quiet important 'erm' like I said in our department we have no 'erm' protocols set aside for this, we are not educated about it, we don't have awareness about it, 'er' so I think it's really important that we (.) establish some sort of (.) 'erm' some sort of (.) what can I say (.) ways to educate us and (.) because it is a reality, there are non-accidental injury, we don't know (.) 'erm' how to classify non-accidental injury so it would be highly important for us to understand this, so that we can also set aside protocols, we can establish training for radiographers how to handle the patients.

Appendix 11: Certificate from the professional editor

GENEVIEVE WOOD

P.O. BOX 511 WITS 2050 | 0616387159

EDITING CERTIFICATE

LANGUAGE EDITING SERVICES

Date: 2019/12/9

This serves to confirm that the document entitled:

Knowledge and practice of radiographers when imaging children with non-accidental injuries at public hospitals: A qualitative study in KwaZulu-Natal Province, South Africa
by Olehile Lekaota, B.Tech Radiography: Diagnostic

has been language edited on behalf of its author, with recommendations for improvement.

Genevieve Wood

PhD candidate

Wits University